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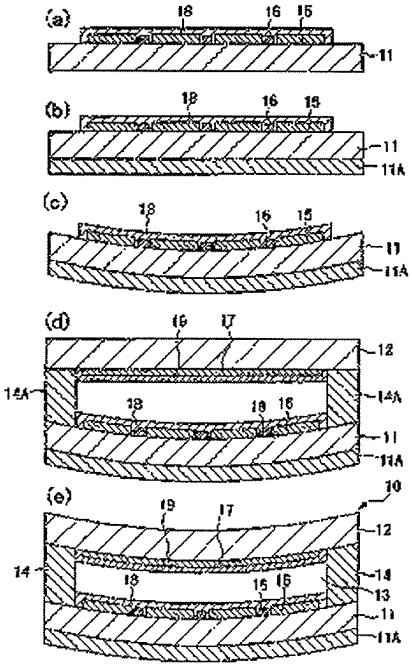
(54)【発明の名称】　液晶装置の製造方法、液晶装置及び電子機器

(57)【要約】
【課題】　液晶層を挟持する対向する２枚の基板が異なる材料からなる場合に、液晶セルのセル厚の均一化を可能にする液晶表示装置の製造方法を提供する。
【解決手段】　液晶層１３を挟持する基板１１と対向基板１２として、異なる基板が用いられており、対向基板１２の熱膨張係数が基板１１の熱膨張係数より小さいなっている。内表面上に、画素電極１５などを形成した基板１１の外表面上に、接着剤を介して、基板１１とは異なる所定の熱膨張係数を有する平板部材１１Ａを貼着する。基板１１と平板部材１１Ａを所定の温度以上に加熱した後、常温に戻すことにより、基板１１と対向基板１１Ａのうち、熱膨張係数の大きい方が熱膨張係数の小さい方よりも昇温とともに大きく膨張し、降温とともに大きく収縮するので、基板１１を所定の形状に湾曲させることができる。その後、基板１１と対向基板１２とをシール材１４を介して所定の間隔で貼着する。



【特許請求の範囲】

【請求項１】　周縁部においてシール材を介して所定の間隔で貼着された、液晶層を挟持する対向する２枚の基板が異なる材料からなる液晶装置の製造方法において、前記対向する２枚の基板のうち、熱膨張係数の大きい基板の外表面上に、接着剤を介して、該基板とは異なる所定の熱膨張係数を有する平板部材を貼着し所定の温度以上に加熱した後、常温に戻すことにより、該基板と該平板部材とを所定の形状に湾曲させた後、該基板ともう一方の前記基板とを前記シール材を介して貼着することを特徴とする液晶装置の製造方法。

【請求項２】　請求項１記載の液晶装置の製造方法において、前記平板部材は前記基板の熱膨張係数より小さい熱膨張係数を有するものであり、前記基板と前記平板部材とを該平板部材側が凸になるように湾曲させたことを特徴とする液晶装置の製造方法。

【請求項３】　請求項２記載の液晶装置の製造方法において、前記基板と前記平板部材の熱膨張係数の差が、前記もう一方の基板と前記基板の熱膨張係数の差に等しいことを特徴とする液晶装置の製造方法。

【請求項４】　請求項１記載の液晶装置の製造方法において、前記平板部材は前記基板の熱膨張係数より大きい熱膨張係数を有するものであり、前記基板と前記平板部材とを該基板側が凸になるように湾曲させたことを特徴とする液晶装置の製造方法。

【請求項５】　請求項４記載の液晶装置の製造方法において、前記基板と前記平板部材の熱膨張係数の差が、前記もう一方の基板と前記基板の熱膨張係数の差に等しいことを特徴とする液晶装置の製造方法。

【請求項６】　請求項１から請求項５までのいずれか１項記載の液晶装置の製造方法において、前記接着剤が前記シール材と同一の材料からなることを特徴とする液晶装置の製造方法。

【請求項７】　周縁部においてシール材を介して所定の間隔で貼着された、液晶層を挟持する対向する２枚の基板が異なる材料からなる液晶装置において、前記対向する２枚の基板のうち、熱膨張係数の大きい基板の外表面上に、接着剤を介して、該基板とは異なる所定の熱膨張係数を有する平板部材が貼着され、該基板、該平板部材、もう一方の前記基板が所定の形状に湾曲されたことを特徴とする液晶装置。

【請求項８】　請求項７記載の液晶装置において、前記平板部材は前記基板の熱膨張係数より小さい熱膨張係数を有するものであり、前記基板と前記平板部材とは該平板部材側が凸になるように湾曲され、前記もう一方の基板は内表面側が凸になるように湾曲されたことを特徴とする液晶装置。

【請求項９】　請求項８記載の液晶装置において、前記基板と前記平板部材の熱膨張係数の差が、前記もう一方の基板と前記基板の熱膨張係数の差に等しいことを特徴とする液晶装置。

【請求項１０】　請求項７記載の液晶装置において、前記平板部材は前記基板の熱膨張係数より大きい熱膨張係数を有するものであり、前記基板と前記平板部材とは該基板側が凸になるように湾曲され、前記もう一方の基板は外表面側が凸になるように湾曲されたことを特徴とする液晶装置。

【請求項１１】　請求項１０記載の液晶装置において、前記基板と前記平板部材の熱膨張係数の差が、前記もう一方の基板と前記基板の熱膨張係数の差に等しいことを特徴とする液晶装置。

【請求項１２】　請求項７から請求項１１までのいずれか１項記載の液晶装置において、前記接着剤が前記シール材と同一の材料からなることを特徴とする液晶装置。

【請求項１３】　請求項７から請求項１２までのいずれか１項記載の液晶装置を備えることを特徴とする電子機器。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、液晶装置の製造方法、液晶装置及び電子機器に係り、特に液晶層を挟持する対向する２枚の基板が異なる材料からなる液晶装置の製造方法、該製造方法により製造される液晶装置、該液晶装置を備える電子機器に関する。

【０００２】

【従来の技術】液晶ディスプレイとして、携帯電話や携帯型情報処理装置などに搭載される直視型液晶ディスプレイと、プロジェクタなどの投射型液晶ディスプレイとが知られている。

【０００３】図７に、直視型液晶ディスプレイに用いられる一般の液晶表示装置１００の概略断面図を示し、この液晶表示装置の構造を説明する。

【０００４】図７に示すように、基板（下側基板）１０１と対向基板（上側基板）１０２とがそれぞれの周縁部においてシール材１０４を介して所定間隔で貼着され、基板１０１、対向基板１０２間に液晶層１０３が封入されている。基板１０１と対向基板１０２の内面上にはそれぞれ所定のパターンで透明電極１０５、１０６が形成され、透明電極１０５、１０６上には配向膜１０７、１０８が形成されている。

【０００５】基板１０１、対向基板１０２の外側には位相差板、偏光板が設置されるが、図示では省略している。

【０００６】液晶表示装置１００において、基板１０１及び対向基板１０２の間隔（液晶セルのセル厚）を一定に保つために、二酸化珪素、ポリスチレンなどからなる多数の球状のスペーサー１０９が基板１０１、対向基板１０２間に配置されている。

【０００７】次に、図８に、投射型液晶ディスプレイに用いられる一般の液晶表示装置２００の概略断面図を示

し．この液晶表示装置の構造を説明する。図８において．液晶表示装置１００と同じ構成要素には同じ参照番号を付し、説明は省略する。

【０００８】液晶表示装置２００においては、液晶パネルを拡大投影して表示を行うため、基板１０１．対向基板１０２間にスペーサーを配置した場合に、スペーサーも拡大して表示されるので．その部分に光漏れが生じ、表示品質を低下させるという問題がある。そのため、液晶表示装置２００においては、図８に示すように．基板１０１、対向基板１０２間にスペーサーを配置することができない。

【０００９】

【発明が解決しようとする課題】上記の液晶表示装置１００．２００で示したような一般の液晶表示装置において．基板１０１．対向基板１０２として、通常は同一の基板が用いられるが、異なる基板が用いられる場合がある。

【００１０】基板１０１．対向基板１０２として．異なる基板が用いられる例として、図９に投射型ディスプレイに用いられる反射型液晶表示装置３００を示し．この液晶表示装置の構造を説明する。図９において．液晶表示装置２００と同じ構成要素には同じ参照番号を付し、説明は省略する。

【００１１】基板１０１上には、光を反射するアルミニウムなどからなる反射電極３０５がマトリックス状に多数形成されていて、各反射電極３０５を駆動するためのスイッチング素子が設けられている。反射電極３０５及びスイッチング素子上には配向膜１０７が形成されている。

【００１２】この液晶表示装置３００において．対向基板１０２の外側から液晶パネル内に入射した光は液晶層１０３を通過し．反射電極３０５表面で反射され．対向基板１０２を通過し、液晶パネルの外部へと放出される。

【００１３】この液晶表示装置３００において．基板１０１が単結晶シリコンなどの単結晶材料からなり．スイッチング素子がこの単結晶基板上に形成されている時には．ガラス等のアモルファス材料上形成されたスイッチング素子からなる時よりも．基板１０１上に形成される反射電極３０５を高速にスイッチングすることができる。

【００１４】一方、反射電極３０５で反射された光が対向基板１０２を通過し、液晶表示装置３００の外部へ放出され、表示が行われるため、対向基板１０２は透明であることが必要となる。そのため、対向基板１０２として．不透明な単結晶シリコン等を用いることができない。

【００１５】したがって．反射型液晶表示装置３００を高速応答させたい場合や基板１０１上にトランジスタを形成する場合には、基板１０１としては単結晶シリコン

などの単結晶材料からなる基板が用いられ、対向基板１０２としてはガラスなどの透明材料からなる基板が用いられるので、基板１０１．対向基板１０２として．異なる材料からなる基板が用いられる。

【００１６】基板１０１．対向基板１０２として．異なる基板が用いられる液晶表示装置３００においては、液晶表示装置３００の製造工程において．シール材１０４を形成する際に．基板１０１、対向基板１０２との間でセル厚ムラを生じるという問題点を有する。

【００１７】シール材１０４は、基板１０１、対向基板１０２の周縁部間に熱硬化性接着剤又は光硬化性接着剤を塗布し、接着剤を硬化することにより形成される。接着剤の硬化は．熱硬化性接着剤の場合には、通常１００～１６０℃程度に加熱することにより行われ、光硬化性接着剤の場合には、紫外線等を照射することにより行われる。光硬化性接着剤の場合には、加熱は行われないが．紫外線ランプのからの発熱で、８０℃程度まで昇温する。

【００１８】したがって．シール材１０４として．熱硬化性接着剤、光硬化性接着剤のいずれを使用する場合においても、液晶セルは１００～１６０℃程度あるいは８０℃程度に加熱される。

【００１９】その際、基板１０１、対向基板１０２として異なる基板が用いられているので．基板１０１と対向基板１０２の熱膨張係数が異なり、熱膨張係数の大きい基板が、熱膨張係数の小さい基板と比較して、温度上昇とともに大きく膨張する。さらに、基板の周縁部はシール材１０４によって固定されているので、膨張した基板に湾曲が生じる。

【００２０】例えば、基板１０１が単結晶シリコン、対向基板１０２がガラスからなる場合には、単結晶シリコンの方がガラスよりも熱膨張係数が大きいため．対向基板１０２は、図１０(a)に示すように、対向基板１０２の内表面側が凸になるように湾曲するか、あるいは図１０(b)に示すように．対向基板１０２の外表面側が凸になるように湾曲する。図１０(a)．(b)に示す、対向基板１０２のいずれの湾曲においても、対向基板１０２が水平な場合からのずれは、対向基板１０２の中央部でもっとも顕著となっている。例えば、基板１０１の厚みが０．６×１０$^{-3}$ｍ、対向基板１０２の厚みが０．７×１０$^{-3}$ｍの場合には、対向基板１０２の中央部におけるずれの大きさｇは１×１０$^{-6}$ｍ程度となっている。そのため．基板１０１と対向基板１０２に挟持される液晶層１０３の厚み（液晶セルのセル厚）にも１×１０$^{-6}$ｍ程度の分布が生じるという問題点がある。液晶セルのセル厚は３～６×１０$^{-6}$ｍ程度であるので．このずれは大きいものとなっている。

【００２１】以上の問題は．投射型ディスプレイ用の反射型液晶表示装置３００に限った問題ではなく．基板１０１と対向基板１０２とが異なる基板からなる液晶表示

装置であればいかなる液晶表示装置においても生じる問題である。

【００２２】スペーサー１０９を配置する一般の直視型液晶ディスプレイ用の液晶表示装置１００においては、図１０(a)で示した対向基板１０２の湾曲を防止することはできるが、スペーサー１０９を配置しても図１０(b)で示した対向基板１０２の湾曲を防止することはできない。

【００２３】また、スペーサーを配置しない一般の投射型液晶ディスプレイ用の液晶表示装置２００（３００を含む）においては、図１０(a)、図１０(b)で示したいずれの対向基板１０２の湾曲も防止することができず、問題は顕著となっている。

【００２４】ここで、液晶セルのセル厚に分布が生じるときの問題について説明する。液晶セルのセル厚に分布が生じると、液晶表示装置において、表示性能が悪化することが知られている。特にＳＴＮ(Super Twisted Nematic)モードの液晶表示装置においては、Δｎ・ｄ値（但し、Δｎは液晶の複屈折率、ｄはセル厚）の変化により光の透過率が変化することが知られており、Δｎ・ｄ値の変化、すなわちセル厚ｄの分布が大きいと光透過率すなわち明るさに分布が発生するため、コントラストが低下する。Δｎ・ｄ値の変化すなわちセル厚ｄの分布が大きいと、ＳＴＮモードでは位相差板で独特の黄色や青色の着色をなくし、白黒に補償することが行われるが、このとき、光学特性が悪化し、表示に色むらが生じてしまう。また、セル厚ｄに分布があると液晶の急峻性が悪化し、コントラストが低下する。このようにセル厚ｄに分布が生じることにより、コントラストが悪化し、表示に色むらが発生するため、表示品質が悪化するという問題がある。

【００２５】そこで、本発明は上記問題点を解決し、液晶層を挟持する基板、対向基板が異なる材料からなる液晶表示装置の製造方法において、液晶セルのセル厚の均一化を可能にする液晶表示装置の製造方法を提供することを目的とする。また、この製造方法により表示品質の優れた液晶表示装置を提供することを目的とし、さらにこの液晶表示装置を備えることにより、表示品質の優れた電子機器を提供することを目的とする。

【００２６】

【課題を解決するための手段】上記課題を解決するために本発明者が検討を行った結果、液晶層を挟持する基板と対向基板のうち、熱膨張係数の大きい基板の外表面上に、接着剤を介して、該基板の熱膨張係数とは異なる所定の熱膨張係数を有する平板部材を貼着し、所定の温度以上に加熱した後、常温に戻すことにより、該基板と該平板部材とを所定の形状に湾曲させることができることを見出し、基板と対向基板とを同一の形状に湾曲させることにより、液晶セルのセル厚を均一化できることを見出した。

【００２７】本発明者が見出した基板の湾曲方法について説明する。

【００２８】熱膨張係数の大きい基板の外表面上に、接着剤を介して、該基板の熱膨張係数とは異なる所定の熱膨張係数を有する平板部材を貼着し、所定の温度以上に加熱した後、常温に戻すと、該基板と該平板部材のうち、熱膨張係数の大きい方が小さい方よりも昇温とともに大きく膨張し、降温とともに大きく収縮する。

【００２９】したがって、平板部材の熱膨張係数が基板の熱膨張係数より小さい場合には、基板と平板部材とは、平板部材側が凸になるように湾曲する。一方、平板部材の熱膨張係数が基板の熱膨張係数より大きい場合には、基板と平板部材とは、基板側が凸になるように湾曲する。

【００３０】このように基板と平板部材の熱膨張係数の差を制御することにより、シール材の形成工程において湾曲するもう一方の熱膨張係数が小さい基板と同一の形状に、基板をあらかじめ湾曲させることができるので、液晶セルのセル厚を均一化することができる。

【００３１】すなわち、上記課題を解決するために本発明が講じた手段は、周縁部においてシール材を介して所定の間隔で貼着された、液晶層を挟持する対向する２枚の基板が異なる材料からなる液晶装置の製造方法において、前記対向する２枚の基板のうち、熱膨張係数の大きい基板の外表面上に、接着剤を介して、該基板とは異なる所定の熱膨張係数を有する平板部材を貼着し、所定の温度以上に加熱した後、常温に戻すことにより、該基板と該平板部材とを所定の形状に湾曲させた後、該基板ともう一方の前記基板とを前記シール材を介して貼着することを特徴とする。

【００３２】この手段によれば、液晶層を挟持する対向する２枚の基板のうち、熱膨張係数の大きい基板をあらかじめ所定の形状に湾曲させることにより、シール材の形成工程において湾曲するもう一方の基板との間隔（液晶セルのセル厚）を均一化することができる液晶装置の製造方法を提供することができる。

【００３３】また、この手段により、周縁部においてシール材を介して所定の間隔で貼着された、液晶層を挟持する対向する２枚の基板が異なる材料からなる液晶装置において、前記対向する２枚の基板のうち、熱膨張係数の大きい基板の外表面上に、接着剤を介して、該基板とは異なる所定の熱膨張係数を有する平板部材が貼着され、該基板、該平板部材、もう一方の前記基板が所定の形状に湾曲されたことを特徴とする、表示品質の優れた液晶装置を提供することができる。

【００３４】また、この液晶装置を備えることにより、表示品質の優れた電子機器を提供することができる。

【００３５】以上の手段において、前記平板部材が前記基板の熱膨張係数より小さい熱膨張係数を有するものである場合には、前記基板と前記平板部材とを該平板部材

側が凸になるように湾曲させたことを特徴とする。前記平板部材が前記基板の熱膨張係数より大きい熱膨張係数を有するものである場合には、前記基板と前記平板部材とを該基板側が凸になるように湾曲させたことを特徴とする。

【００３６】いずれの場合においても、前記基板と前記平板部材の熱膨張係数の差が、前記もう一方の基板と前記基板の熱膨張係数の差に等しいことが望ましい。前記基板と前記平板部材の熱膨張係数の差を、前記もう一方の基板と前記基板の熱膨張係数の差と等しくすることにより、前記平板部材を貼着した前記基板をもう一方の基板と同一の形状に湾曲させることができる。

【００３７】また、前記接着剤は前記シール材と同一の材料からなることが望ましい。前記接着剤を前記シール材と同一の材料とし、該シール材を硬化する条件で該接着剤を硬化することにより、前記平板部材を貼着した前記基板をもう一方の基板と同一の形状に湾曲させることができる。

【００３８】

【発明の実施の形態】次に、本発明に係る実施形態について詳細に説明する。

【００３９】第１実施形態

図１(a)～(e)に、本発明に係る第１実施形態の、スイッチング素子としてＭＯＳＦＥＴ（メタルオキサイドシリコンフィールドエミッショントランジスタ）素子２０を用いる反射型液晶表示装置１０の製造方法を示す工程図を示し、この製造方法を説明する。図１(a)～(e)は概略断面図を示している。

【００４０】本実施形態においては、液晶層１３を挟持する基板（下側基板）１１と対向基板（上側基板）１２として、異なる基板が用いられており、対向基板１２の熱膨張係数の方が基板１１の熱膨張係数より小さくなっている。例えば、基板１１、対向基板１２として、それぞれ単結晶シリコン、ガラスからなる基板が用いられている。また、基板１１、対向基板１２を貼着するシール材１４の形成工程において、対向基板１２は内表面側（液晶層１３側）が凸になるように湾曲するものとする。

【００４１】図１(a)に示すように、基板１１の内表面（図示上側表面）上には、光を反射するアルミニウムなどからなる画素電極（反射電極）１５と、各画素電極１５を駆動するためのＭＯＳＦＥＴ素子２０などを形成し、画素電極１５、ＭＯＳＦＥＴ素子２０上には配向膜１８を形成する。

【００４２】図２に、配向膜１８を形成する前の基板１１を上から見たときの様子を拡大した平面図を示す。図１(a)は、図２のＡ－Ａ′線に沿って示す断面図である。

【００４３】図２に示すように、基板１１上には、走査線２２とデータ線１６がマトリックス状に配置され、走査線２２とデータ線１６との交点に応じて各画素が配置され、各画素には画素電極１５と、各画素電極１５を駆動するためのＭＯＳＦＥＴ素子２０とが設けられている。ＭＯＳＦＥＴ素子２０の詳細な説明については後述する。

【００４４】次に、図１(b)に示すように、基板１１の外表面（図示下側表面）上に、熱硬化性接着剤又は光硬化性接着剤を介して、基板１１とは異なる所定の熱膨張係数を有する平板部材１１Ａを貼着する。このとき、平板部材１１Ａの熱膨張係数が基板１１の熱膨張係数より小さくなるように平板部材１１Ａを選定する。また、対向基板１２と基板１１の熱膨張係数の差と、基板１１と平板部材１１Ａの熱膨張係数の差が等しくなるように、設定することが望ましい。平板部材１１Ａは対向基板１２と同一の材料から構成されてもよい。

【００４５】基板１１と平板部材１１Ａを貼着した接着剤が熱硬化性接着剤の場合には、１００～１６０℃程度に加熱することにより接着剤の硬化を行う。また、用いた接着剤が光硬化性接着剤の場合には紫外線等を照射することにより接着剤の硬化を行う。光硬化性接着剤の硬化には紫外線ランプを使用し、紫外線ランプの発熱により８０℃程度まで昇温する。また、いずれの接着剤を用いた場合においても硬化反応終了後は常温まで温度を下げる。

【００４６】用いた接着剤が熱硬化性接着剤、光硬化性接着剤のいずれの場合においても基板１１と平板部材１１Ａとは１００～１６０℃程度あるいは８０℃程度の温度に加熱される。このとき、基板１１と対向基板１１Ａのうち、熱膨張係数の大きい基板１１が熱膨張係数の小さい平板部材１１Ａよりも昇温とともに大きく膨張し、降温とともに大きく収縮する。

【００４７】その結果、図１(c)に示すように、基板１１と平板部材１１Ａとは、平板部材１１Ａ側が凸になるように湾曲する。

【００４８】次に、図１(d)に示すように、共通電極１７、配向膜１９が内表面上に順次形成された対向基板１２と基板１１とを、熱硬化性接着剤又は光硬化性接着剤からなる未硬化のシール材１４Ａを介して所定の間隔で貼着する。

【００４９】次に、図１(e)に示すように、シール材１４Ａの硬化を行い、シール材１４を形成する。シール材１４Ａが熱硬化性接着剤の場合には、１００～１６０℃程度に加熱することにより接着剤の硬化を行う。また、シール材１４Ａが光硬化性接着剤の場合には紫外線等を照射することにより接着剤の硬化を行う。光硬化性接着剤の硬化には紫外線ランプを使用し、紫外線ランプの発熱により８０℃程度まで昇温する。また、いずれの接着剤を用いた場合においても、硬化反応終了後は常温まで温度を下げる。

【００５０】シール材１４Ａとして用いた接着剤が熱硬

化性接着剤、光硬化性接着剤のいずれの場合においても．基板１１と平板部材１１Ａとは１００～１６０℃あるいは８０℃程度の温度に加熱される。このとき．対向基板１２の熱膨張係数が基板１１の熱膨張係数より小さいため、小さい対向基板１２は基板１１よりも大きく熱膨張する。しかしながら．対向基板１２の周縁部はシール材１４Ａ又は１４によって固定されているため．対向基板１２は内表面側が凸になるように湾曲する。

【００５１】最後に、基板１１、対向基板１２間に液晶層１３を封入し．図示では省略しているが平板部材１１Ａ．対向基板１２の外側に位相差板．偏光板を設置し、液晶表示装置１０は製造される。

【００５２】ここで、ＭＯＳＦＥＴ（メタルオキサイドシリコンフィールドエミッショントランジスタ）素子２０の詳細について説明する。

【００５３】図３に、ＭＯＳＦＥＴ素子２０の詳細を示すために、図２のＢ－Ｂ’線に沿って示す断面図を示す。

【００５４】基板１１上には、ウェル領域２１が形成され．ウェル領域２１上には素子分離用のフィールド酸化膜２３が形成されている。フィールド酸化膜２３には開口部が形成され．この開口部の内側中央に、ゲート酸化膜２４が形成され、ゲート酸化膜２４表面にはゲート電極２２ａ及び走査線２２が形成され．その上に第１の層間絶縁膜２５が形成されている。コンタクトホール２６はソース領域４２ａに形成され、これにより第１の層間絶縁膜２５は開口し、ここにデータ線１６が形成され、ソース領域４２ａとの接続が図られている。また．データ線１６が形成された後には、さらに第２の層間絶縁膜２７が形成される。コンタクトホール２８は、ドレイン領域４２ｂに形成され、これにより．第１の層間絶縁膜２５．第２の層間絶縁膜２７が開口し．ここに．画素電極１５が形成されて、ドレイン領域４２ｂとの接続が図られている。また、第１の層間絶縁膜２５と第２の層間絶縁膜２７との間には容量蓄積用の導電層２９が形成される。

【００５５】本実施形態においては．基板１１．対向基板１２のうち．対向基板１２の熱膨張係数が基板１１の熱膨張係数より小さい液晶表示装置について説明したが．本発明はこれに限定されるものではなく、基板１１の熱膨張係数が対向基板１２の熱膨張係数より小さいてもよく、その場合には、対向基板１２の外表面上に対向基板１２の熱膨張係数より小さい熱膨張係数を有する平板部材１１Ａを貼着し、対向基板１２と平板部材１１Ａとを．平板部材１１Ａ側が凸になるように湾曲すればよい。

【００５６】本実施形態によれば、基板１１の外表面上に熱膨張係数の異なる所定の熱膨張係数を有する平板部材１１Ａを貼着し、所定の温度以上に昇温し、常温に戻すことにより．基板１１を所定の形状に湾曲することができる。

【００５７】本実施形態において、対向基板１２と基板１１の熱膨張係数の差と．基板１１と平板部材１１Ａの熱膨張係数の差が等しくなるように．設定することが望ましい。また．基板１１と平板部材１１Ａとを貼着する接着剤として．シール材１４Ａと同一の接着剤が用いられることが望ましい。

【００５８】対向基板１２と基板１１の熱膨張係数の差と．基板１１と平板部材１１Ａの熱膨張係数の差が等しくなるように設定し、基板１１と平板部材１１Ａとを貼着する接着剤として、シール材１４Ａと同一の接着剤を用い．同一条件下で接着剤の硬化を行うことにより、基板１１と対向基板１２とを．同一の形状に湾曲させることができる。

【００５９】このように．本実施形態によれば．基板１１を．シール材１４の形成工程において湾曲する対向基板１２と同一の形状に湾曲することができるので．液晶セルのセル厚が均一化され．表示品質の優れた液晶表示装置の製造方法及び液晶表示装置を提供することができる。

【００６０】また、本実施形態においては、反射型液晶表示装置について説明したが、本発明は反射型に限定されるものではなく、透過型．反射半透過型など．いかなる液晶装置にも適用することができる。なお、本実施形態はスペーサーを配置することができない投射型液晶ディスプレイ用の液晶表示装置には特に有効である。

【００６１】第２実施形態図４に、本発明に係る第２実施形態の、スイッチング素子としてＭＯＳＦＥＴ素子を用いる反射型液晶表示装置３０の製造方法を示す工程図を示し、製造方法を説明する。図４において、液晶表示装置１０と同じ構成要素には同じ参照符号を付している。

【００６２】本実施形態においては．液晶層１３を挟持する基板（下側基板）３１と対向基板（上側基板）３２として、異なる基板が用いられており．対向基板３２の熱膨張係数の方が基板３１の熱膨張係数より小さくなって小さくいる。例えば、基板３１、対向基板３２として．それぞれ単結晶シリコン、ガラスからなる基板が用いられている。また、基板３１、対向基板３２を貼着するシール材１４の形成工程において．対向基板３２は外表面側が凸になるように湾曲するものとする。

【００６３】図４(a)に示すように、基板３１の内表面（図示上側表面）上には．第１実施形態と同様．光を反射するアルミニウムなどからなる画素電極（反射電極）１５と、各画素電極１５を駆動するためのＭＯＳＦＥＴ素子２０などが設けられている。

【００６４】配向膜１８を形成する前の基板３１を上から見たときの様子を拡大した平面図．及びＭＯＳＦＥＴ素子２０の詳細な構造は図２、図３で示したものと同様であるので、説明は省略する。

【００６５】次に、図４(b)に示すように、基板３１の外表面（図示下側表面）上に、熱硬化性接着剤又は光硬化性接着剤を介して、基板３１とは異なる所定の熱膨張係数を有する平板部材３１Ａを貼着する。このとき、平板部材３１Ａの熱膨張係数が基板３１の熱膨張係数より大きくなるように平板部材３１Ａを選定する。また、対向基板３２と基板３１の熱膨張係数の差と、基板３１と平板部材３１Ａの熱膨張係数の差が等しくなるように、設定することが望ましい。

【００６６】基板３１と平板部材３１Ａとを貼着した接着剤が熱硬化性接着剤の場合には、１００～１６０℃程度に加熱することにより接着剤の硬化を行う。また、用いた接着剤が光硬化性接着剤の場合には紫外線等を照射することにより接着剤の硬化を行う。光硬化性接着剤の硬化には紫外線ランプを使用し、紫外線ランプの発熱により８０℃程度まで昇温する。また、いずれの接着剤を用いた場合においても硬化反応終了後は常温まで温度を下げる。

【００６７】用いた接着剤が熱硬化性接着剤、光硬化性接着剤のいずれの場合においても、基板３１と平板部材３１Ａとは１００～１６０℃程度あるいは８０℃程度の温度に加熱される。このとき、基板３１と平板部材３１Ａのうち、熱膨張係数の大きい平板部材３１Ａが熱膨張係数の小さい基板３１よりも昇温とともに大きく膨張し、降温とともに大きく収縮する。

【００６８】その結果、図４(c)に示すように、基板３１と平板部材３１Ａとは、基板３１側が凸になるように湾曲する。

【００６９】次に、図４(d)に示すように、共通電極１７、配向膜１９が内表面上に順次形成された対向基板３２と基板３１とを、熱硬化性接着剤又は光硬化性接着剤からなる未硬化のシール材１４Ａを介して所定の間隔で貼着する。

【００７０】次に、図４(e)に示すように、シール材１４Ａの硬化を行い、シール材１４を形成する。シール材１４Ａが熱硬化性接着剤の場合には、１００～１６０℃程度に加熱することにより接着剤の硬化を行う。また、シール材１４Ａが光硬化性接着剤の場合には紫外線等を照射することにより接着剤の硬化を行う。光硬化性接着剤の硬化には紫外線ランプを使用し、紫外線ランプの発熱により８０℃程度まで昇温する。また、いずれの接着剤を用いた場合においても、硬化反応終了後は常温まで温度を下げる。

【００７１】シール材１４Ａとして用いた接着剤が熱硬化性接着剤、光硬化性接着剤のいずれの場合においても、基板３１と平板部材３１Ａとは１００～１６０℃程度あるいは８０℃程度の温度に加熱される。このとき、対向基板３２の熱膨張係数が基板３１の熱膨張係数より小さいため、基板３１は対向基板３２よりも大きく熱膨張する。しかしながら、対向基板３２の周縁部はシール材１４Ａ又は１４によって固定されているため、対向基板３２は外表面側が凸になるように湾曲する。

【００７２】最後に、基板３１、対向基板３２間に液晶層１３を封入し、図示では省略しているが平板部材３１Ａ、対向基板３２の外側に位相差板、偏光板を設置し、液晶表示装置３０は製造される。

【００７３】本実施形態においては、基板３１、対向基板３２のうち、対向基板３２の熱膨張係数が基板３１の熱膨張係数より小さい液晶表示装置について説明したが、本発明はこれに限定されるものではなく、対向基板３２の熱膨張係数が基板３１の熱膨張係数より大きくてもよく、その場合には、対向基板３２の外表面上に対向基板３２の熱膨張係数より大きい熱膨張係数を有する平板部材３１Ａを貼着し、対向基板３２と平板部材３１Ａとを、対向基板３２側が凸になるように湾曲すればよい。

【００７４】本実施形態によれば、基板３１の外表面上に熱膨張係数の異なる所定の熱膨張係数を有する平板部材３１Ａを貼着し、所定の温度以上に昇温し、常温に戻すことにより、基板３１を所定の形状に湾曲することができる。

【００７５】本実施形態において、対向基板３２と基板３１の熱膨張係数の差と、基板３１と平板部材３１Ａの熱膨張係数の差が等しくなるように、設定することが望ましい。また、基板３１と平板部材３１Ａとを貼着する接着剤として、シール材１４Ａと同一の接着剤が用いられることが望ましい。

【００７６】対向基板３２と基板３１の熱膨張係数の差と、基板３１と平板部材３１Ａの熱膨張係数の差が等しくなるように設定し、基板３１と平板部材３１Ａとを貼着する接着剤として、シール材１４Ａと同一の接着剤を用い、同一条件下で接着剤の硬化を行うことにより、基板３１と対向基板３２とを、同一の形状に湾曲させることができる。

【００７７】このように、本実施形態によれば、基板３１を、シール材１４の形成工程において湾曲する対向基板３２と同一の形状に湾曲することができるので、液晶セルのセル厚が均一化され、表示品質の優れた液晶表示装置の製造方法及び液晶表示装置を提供することができる。

【００７８】また、本実施形態においては、反射型液晶表示装置について説明したが、本発明は反射型に限定されるものではなく、透過型、反射半透過型など、いかなる液晶装置にも適用することができる。本実施形態はスペーサーを配置することができない投射型ディスプレイ用の液晶表示装置、スペーサーを配置する直視型液晶ディスプレイ用の液晶表示装置のいずれにも有効である。

【００７９】なお、第１、第２実施形態においては、ＭＯＳＦＥＴ素子を用いる液晶表示装置についてのみ説明したが、本発明はこれに限定されるものではなく、例え

ば．単純マトリックスタイプの液晶装置や、ＭＩＭ（Metal-Insulator-Metal）素子に代表される２端子型素子を用いる液晶装置、ＴＦＴ（Thin-Film Transistor）素子に代表される３端子型素子を用いる液晶装置にも適用することができ．液晶層を挟持する対向する２枚の基板が異なる材料からなる液晶装置であれば、いかなる液晶装置にも適用することができる。

【００８０】次に、前記の第１、第２実施形態の液晶表示装置１０又は３０のいずれかを備えた電子機器の具体例について説明する。

【００８１】図５(a)は、携帯電話の一例を示した斜視図である。図５(a)において、４０は携帯電話本体を示し．４１は前記の液晶表示装置１０又は３０のいずれかを備えた液晶表示部を示している。

【００８２】図５(b)は、ワープロ、パソコンなどの携帯型情報処理装置の一例を示した斜視図である。図５(b)において、５０は情報処理装置、５１はキーボードなどの入力部．５３は情報処理本体．５２は前記の液晶表示装置１０又は３０のいずれかを備えた液晶表示部を示している。

【００８３】図５(c)は、腕時計型電子機器の一例を示した斜視図である。図５(c)において、６０は時計本体を示し、６１は前記の液晶表示装置１０又は３０のいずれかを備えた液晶表示部を示している。

【００８４】図６は、前記の液晶表示装置１０又は３０のいずれかを光変調装置として用いたプロジェクタ（投射型液晶ディスプレイ）の要部を示す概略構成図である。

【００８５】このプロジェクタは、システム光軸Ｌに沿って配置した光源部７１．インテグレータレンズ７２、偏光変換素子７３から概略構成される偏光照明装置７０．偏光照明装置７０から出射されたＳ偏光光束をＳ偏光光束反射面８１により反射させる偏光ビームスプリッタ８０、偏光ビームスプリッタ８０のＳ偏光反射面８１から反射された光のうち．青色光（Ｂ）の成分を分離するダイクロイックミラー８２、分離された青色光（Ｂ）を変調する反射型液晶光変調装置８５Ｂ、青色光が分離された後の光束のうち赤色光（Ｒ）の成分を反射させて分離するダイクロイックミラー８３．分離された赤色光（Ｒ）を変調する反射型液晶光変調装置８５Ｒ．ダイクロイックミラー８３を透過する残りの緑色光（Ｇ）を変調する反射型液晶光変調装置８５Ｇ．３つの反射型液晶光変調装置８５Ｒ、８５Ｇ．８５Ｂにて変調された光をダイクロイックミラー８２．８３、偏光ビームスプリッタ８０にて合成し、この合成光をスクリーン９１に投射する投射レンズからなる投射光学系９０から構成されている。上記３つの反射型液晶光変調装置８５Ｒ．８５Ｇ．８５Ｂには．それぞれ前記の液晶表示装置１０又は３０のいずれかが用いられている。

【００８６】図５(a)～(c)．図６に示すそれぞれの電子機器は、前記の液晶表示装置１０又は３０のいずれかを備えたものであるので、表示品質の優れたものとなる。

【００８７】

【発明の効果】以上説明したように本発明によれば、液晶層を挟持する対向する２枚の基板が異なる材料から構成されている場合において．２枚の基板のうち．熱膨張係数の大きい基板の外表面上に、該基板とは熱膨張係数の異なる所定の熱膨張係数を有する平板部材を貼着し、所定の温度以上に昇温し．常温に戻すことにより．該基板を所定の形状に湾曲させることができるので．該基板を．シール材の形成工程において湾曲するもう一方の基板と同一の形状にすることができ、液晶セルのセル厚が均一化され、表示品質の優れた液晶表示装置の製造方法及び液晶表示装置を提供することができる。

【００８８】また、この液晶表示装置を備えることにより表示品質の優れた電子機器を提供することができる。

【図面の簡単な説明】

【図１】　図１(a)～(e)は本発明に係る第１実施形態の反射型液晶表示装置の製造方法を示す工程図である。

【図２】　図２は本発明に係る第１実施形態の反射型液晶表示装置を拡大して示す平面図である。

【図３】　図３は本発明に係る第１実施形態の反射型液晶表示装置におけるＴＦＴ素子の構造を示す断面図である。

【図４】　図４(a)～(e)は本発明に係る第２実施形態の反射型液晶表示装置の製造方法を示す工程図である。

【図５】　図５(a)は上記実施形態により製造された液晶表示装置を備えた携帯電話の一例を示す図、図５(b)は上記実施形態により製造された液晶表示装置を備えた携帯型情報処理装置の一例を示す図．図５(c)は上記実施形態により製造された液晶表示装置を備えた腕時計型電子機器の一例を示す図である。

【図６】　図６は上記実施形態により製造された液晶表示装置を光変調装置として用いたプロジェクタの要部を示す概略構成図である。

【図７】　図７は直視型液晶ディスプレイ用の一般の液晶表示装置の構造を示す概略断面図である。

【図８】　図８は投射型液晶ディスプレイ用の一般の液晶表示装置の構造を示す概略断面図である。

【図９】　図９は投射型液晶ディスプレイ用の反射型液晶表示装置の構造を示す概略断面図である。

【図１０】　図１０(a)、(b)は投射型液晶ディスプレイ用の反射型液晶表示装置における基板の湾曲の問題を説明する図である。

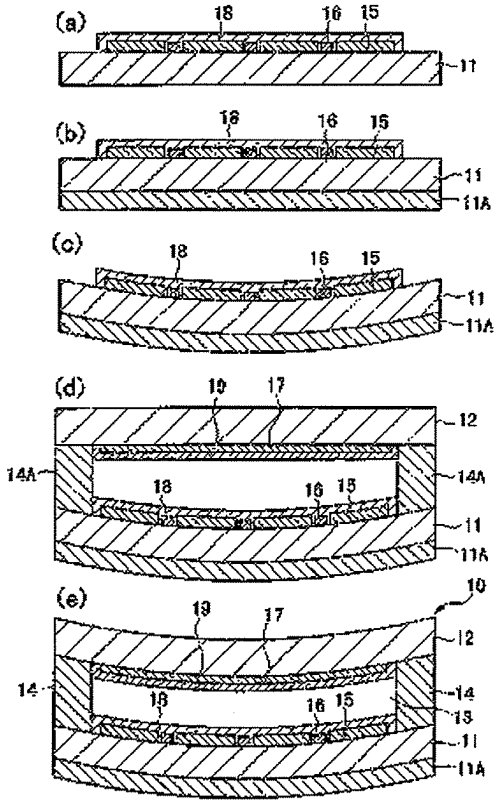
【符号の説明】

１０．３０	液晶表示装置
１１．３１	基板
１１Ａ、３１Ａ	平板部材
１２．３２	対向基板
１３	液晶層

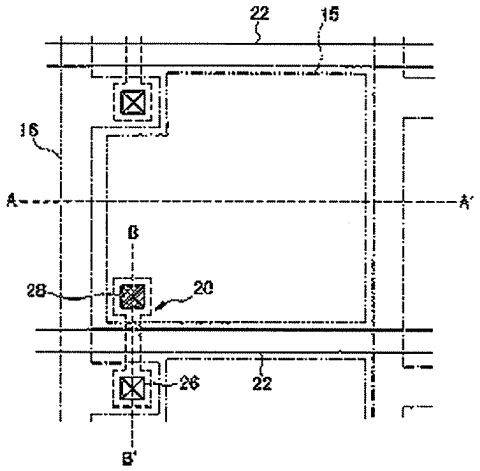
15 16

１４	シール材	＊１７	共通電極
１４Ａ	未硬化のシール材	１８，１９	配向膜
１５	画素電極（反射電極）	２０	ＭＯＳＦＥＴ素子
１６	データ線	＊ ２２	走査線

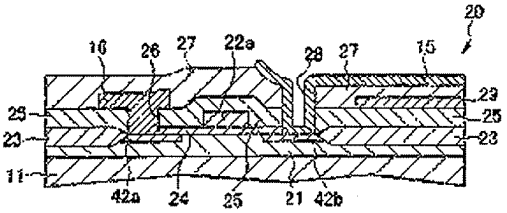
【図１】



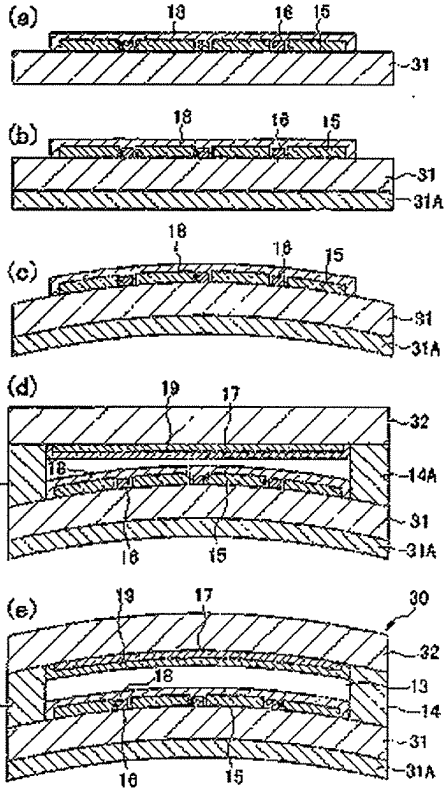
【図２】



【図３】



【図４】



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In the manufacture approach of the liquid crystal equipment which consists of an ingredient with which two substrates which were stuck at the predetermined spacing through the sealant in the periphery section, which pinch a liquid crystal layer, and which counter differ After sticking the monotonous member which has a different predetermined coefficient of thermal expansion from this substrate through adhesives on the outside surface of the substrate with a large coefficient of thermal expansion between said two substrates which counter and heating beyond predetermined temperature, by returning to ordinary temperature The manufacture approach of the liquid crystal equipment characterized by sticking this substrate and said another substrate through said sealant after incurvating this substrate and this monotonous member in a predetermined configuration.
[Claim 2] It is the manufacture approach of the liquid crystal equipment characterized by for said monotonous member having a coefficient of thermal expansion smaller than the coefficient of thermal expansion of said substrate in the manufacture approach of liquid crystal equipment according to claim 1, and incurvating said substrate and said monotonous member so that this monotonous member side may become a convex.
[Claim 3] The manufacture approach of liquid crystal equipment that the difference of the coefficient of thermal expansion of said substrate and said monotonous member is characterized by being equal to the difference of the coefficient of thermal expansion of another [said] substrate and said substrate in the manufacture approach of liquid crystal equipment according to claim 2.
[Claim 4] It is the manufacture approach of the liquid crystal equipment characterized by for said monotonous member having a larger coefficient of thermal expansion than the coefficient of thermal expansion of said substrate in the manufacture approach of liquid crystal equipment according to claim 1, and incurvating said substrate and said monotonous member so that this substrate side may become a convex.
[Claim 5] The manufacture approach of liquid crystal equipment that the difference of the coefficient of thermal expansion of said substrate and said monotonous member is characterized by being equal to the difference of the coefficient of thermal expansion of another [said] substrate and said substrate in the manufacture approach of liquid crystal equipment according to claim 4.
[Claim 6] The manufacture approach of the liquid crystal equipment characterized by said adhesives consisting of the same ingredient as said sealant in the manufacture approach of liquid crystal equipment given [from claim 1 to claim 5] in any 1 term.
[Claim 7] In the liquid crystal equipment which consists of an ingredient with which two substrates which were stuck at the predetermined spacing through the sealant in the periphery section, which pinch a liquid crystal layer, and which counter differ Liquid crystal equipment which the monotonous member which has a different predetermined coefficient of thermal expansion from this substrate is stuck through adhesives on the outside surface of the substrate with a large coefficient of thermal expansion between said two substrates which counter, and is characterized by this substrate, this monotonous member, and said another substrate curving in a predetermined configuration.
[Claim 8] It is liquid crystal equipment which said monotonous member has a coefficient of thermal expansion smaller than the coefficient of thermal expansion of said substrate in liquid crystal equipment according to claim 7, and is characterized by for said substrate and said monotonous member having curved so that this monotonous member side might become a convex, and another [said] substrate curving so that an internal-surface side may become a convex.
[Claim 9] Liquid crystal equipment with which the difference of the coefficient of thermal expansion of said

substrate and said monotonous member is characterized by being equal to the difference of the coefficient of thermal expansion of another [said] substrate and said substrate in liquid crystal equipment according to claim 8.

[Claim 10] It is liquid crystal equipment which said monotonous member has a larger coefficient of thermal expansion than the coefficient of thermal expansion of said substrate in liquid crystal equipment according to claim 7, and is characterized by for said substrate and said monotonous member having curved so that this substrate side might become a convex, and another [said] substrate curving so that an outside-surface side may become a convex.

[Claim 11] Liquid crystal equipment with which the difference of the coefficient of thermal expansion of said substrate and said monotonous member is characterized by being equal to the difference of the coefficient of thermal expansion of another [said] substrate and said substrate in liquid crystal equipment according to claim 10.

[Claim 12] Liquid crystal equipment characterized by said adhesives consisting of the same ingredient as said sealant in liquid crystal equipment given [from claim 7 to claim 11] in any 1 term.

[Claim 13] Electronic equipment characterized by having liquid crystal equipment given [from claim 7 to claim 12] in any 1 term.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to electronic equipment equipped with the liquid crystal equipment manufactured by the manufacture approach of the liquid crystal equipment which consists of an ingredient with which two substrates which are applied to the manufacture approach, liquid crystal equipment, and electronic equipment of liquid crystal equipment, especially pinch a liquid crystal layer, and which counter differ, and this manufacture approach, and this liquid crystal equipment.
[0002]
[Description of the Prior Art] As a liquid crystal display, the direct viewing type liquid crystal display carried in a cellular phone, a pocket mold information processor, etc. and projection mold liquid crystal displays, such as a projector, are known.
[0003] The outline sectional view of the common liquid crystal display 100 used for a direct viewing type liquid crystal display is shown in drawing 7 , and the structure of this liquid crystal display is explained to it.
[0004] As shown in drawing 7 , a substrate (bottom substrate) 101 and the opposite substrate (top substrate) 102 are stuck at intervals of predetermined through a sealant 104 in each periphery section, and the liquid crystal layer 103 is enclosed between the substrate 101 and the opposite substrate 102. On the inside of a substrate 101 and the opposite substrate 102, transparent electrodes 105 and 106 are formed by the predetermined pattern, respectively, and the orientation film 107 and 108 is formed on a transparent electrode 105 and 106.
[0005] Although a phase contrast plate and a polarizing plate are installed in the outside of a substrate 101 and the opposite substrate 102, it is omitting in illustration.
[0006] In the liquid crystal display 100, in order to keep constant spacing (cel thickness of a liquid crystal cell) of a substrate 101 and the opposite substrate 102, many spherical spacers 109 which consist of a silicon dioxide, polystyrene, etc. are arranged between the substrate 101 and the opposite substrate 102.
[0007] Next, the outline sectional view of the common liquid crystal display 200 used for a projection mold liquid crystal display is shown in drawing 8 , and the structure of this liquid crystal display is explained to it. In drawing 8 , the same reference number is given to the same component as a liquid crystal display 100, and explanation is omitted.
[0008] In a liquid crystal display 200, since a spacer is also expanded and displayed when the spacer has been arranged between a substrate 101 and the opposite substrate 102 in order to display by carrying out expansion projection of the liquid crystal panel, optical leakage arises into the part and there is a problem of reducing display quality. Therefore, in a liquid crystal display 200, as shown in drawing 8 , a spacer cannot be arranged between a substrate 101 and the opposite substrate 102.
[0009]
[Problem(s) to be Solved by the Invention] In a common liquid crystal display as shown with the above-mentioned liquid crystal display 100,200, although the same substrate is usually used as a substrate 101 and an opposite substrate 102, a different substrate may be used.
[0010] The reflective mold liquid crystal display 300 with which a different substrate is used as a substrate 101 and an opposite substrate 102 and which is used for a projection mold display as an example at drawing 9 is shown, and the structure of this liquid crystal display is explained. In drawing 9 , the same reference number is given to the same component as a liquid crystal display 200, and explanation is omitted.
[0011] On the substrate 101, many reflectors 305 which consist of aluminum which reflects light are formed in the shape of a matrix, and the switching element for driving each reflector 305 is prepared. The orientation film

107 is formed on the reflector 305 and the switching element.
[0012] In this liquid crystal display 300, the light which carried out incidence into the liquid crystal panel from the outside of the opposite substrate 102 passes the liquid crystal layer 103, it is reflected on reflector 305 front face, and it passes the opposite substrate 102, and is emitted to the exterior of a liquid crystal panel.
[0013] In this liquid crystal display 300, when a substrate 101 consists of single crystal ingredients, such as single crystal silicon, and the switching element is formed on this single crystal substrate, the reflector 305 formed on a substrate 101 can be switched to a high speed rather than the time of consisting of a switching element formed on amorphous materials, such as glass.
[0014] Since the light reflected with the reflector 305 passes the opposite substrate 102 on the other hand, it is emitted to the exterior of a liquid crystal display 300 and a display is performed, it is needed that the opposite substrate 102 is transparent. Therefore, opaque single crystal silicon etc. cannot be used as an opposite substrate 102.
[0015] Therefore, since the substrate which consists of single crystal ingredients, such as single crystal silicon, as a substrate 101 is used and the substrate which consists of transparent materials, such as glass, as an opposite substrate 102 is used when forming a transistor on the case where the high-speed response of the reflective mold liquid crystal display 300 is carried out, or a substrate 101, the substrate which consists of a different ingredient as a substrate 101 and an opposite substrate 102 is used.
[0016] In the liquid crystal display 300 with which a different substrate is used as a substrate 101 and an opposite substrate 102, in the production process of a liquid crystal display 300, in case a sealant 104 is formed, it has the trouble of producing cel thickness nonuniformity between a substrate 101 and the opposite substrate 102.
[0017] A sealant 104 applies thermosetting adhesive or photoresist adhesives between the periphery sections of a substrate 101 and the opposite substrate 102, and is formed by hardening adhesives. In the case of thermosetting adhesive, hardening of adhesives is performed by usually heating at about 100-160 degrees C, and, in the case of photoresist adhesives, is performed by irradiating ultraviolet rays etc. In the case of photoresist adhesives, heating is not performed, but it is generation of heat from that of an ultraviolet ray lamp, and a temperature up is carried out to about 80 degrees C.
[0018] Therefore, as a sealant 104, when using any of thermosetting adhesive and photoresist adhesives, a liquid crystal cell is heated by about 100-160 degrees C or about 80 degrees C.
[0019] Since a different substrate as a substrate 101 and an opposite substrate 102 is used in that case, the coefficients of thermal expansion of a substrate 101 and the opposite substrate 102 differ, and a substrate with a large coefficient of thermal expansion expands greatly with a temperature rise as compared with a substrate with a small coefficient of thermal expansion. Furthermore, since the periphery section of a substrate is being fixed by the sealant 104, a curve arises in the substrate which expanded.
[0020] For example, when single crystal silicon and the opposite substrate 102 consist [a substrate 101] of glass, it curves so that the internal-surface side of the opposite substrate 102 may become a convex, or since the coefficient of thermal expansion is larger than glass, as the direction of single crystal silicon shows the opposite substrate 102 to drawing 10 (a), as shown in drawing 10 R> 0 (b), it curves so that the outside-surface side of the opposite substrate 102 may become a convex. When the opposite substrate 102 is level, the gap from from is the most remarkable also in curve [which / of the opposite substrate 102 shown in drawing 10 (a) and (b)] in the center section of the opposite substrate 102. For example, as for gap g in the center section of the opposite substrate 102, the thickness of 0.6x10 to 3 m and the opposite substrate 102 is about 1x10-6m, when the thickness of a substrate 101 is 0.7x10 to 3 m. Therefore, there is a trouble that distribution of an about [1x10-6m] arises also in the thickness (cel thickness of a liquid crystal cell) of the liquid crystal layer 103 pinched by a substrate 101 and the opposite substrate 102. Since the cel thickness of a liquid crystal cell is about 3-6x10-6m, this gap is large.
[0021] If the above problem is a liquid crystal display which consists of a substrate with which a substrate 101 differs from the opposite substrate 102 instead of the problem restricted to the reflective mold liquid crystal display 300 for a projection mold display, it is a problem produced in any liquid crystal displays.
[0022] In the common liquid crystal display 100 for direct viewing type liquid crystal displays which arranges a spacer 109, although the curve of the opposite substrate 102 shown by drawing 10 (a) can be prevented, even if it arranges a spacer 109, the curve of the opposite substrate 102 shown by drawing 10 (b) cannot be prevented.
[0023] Moreover, neither of the curves of the opposite substrates 102 shown by drawing 10 (a) and drawing 10

(b) can be prevented, but a problem is remarkable in the common liquid crystal display 200 (300 is included) for projection mold liquid crystal displays which does not arrange a spacer.
[0024] Here, a problem in case distribution arises is explained to the cel thickness of a liquid crystal cell. If distribution arises in the cel thickness of a liquid crystal cell, it is known in the liquid crystal display that the display engine performance will get worse. Especially in the liquid crystal display in STN (Super Twisted Nematic) mode, it is known that the permeability of light will change with change of deltan-d value (however, deltan the rate of a birefringence of liquid crystal and d cel thickness), and since distribution will occur in light transmittance, i.e., brightness, if distribution of the deltan-d value change d, i.e., cel thickness, is large, contrast falls. Although losing peculiar yellow and blue coloring with a phase contrast plate, and compensating black and white in STN mode will be performed if distribution of the deltan-d value change d, i.e., cel thickness, is large, at this time, an optical property will get worse and an irregular color will arise in a display. Moreover, if the cel thickness d has distribution, the steepness of liquid crystal will get worse and contrast will fall. Thus, since contrast gets worse and an irregular color occurs in a display when distribution arises in the cel thickness d, there is a problem that display quality deteriorates.
[0025] Then, this invention solves the above-mentioned trouble and it aims at offering the manufacture approach of the liquid crystal display which enables equalization of the cel thickness of a liquid crystal cell in the manufacture approach of the liquid crystal display which consists of an ingredient with which the substrate which pinches a liquid crystal layer differs from an opposite substrate. Moreover, it aims at offering the electronic equipment which was excellent in display quality by having this liquid crystal display further for the purpose of offering the liquid crystal display which was excellent in display quality by this manufacture approach.
[0026]
[Means for Solving the Problem] Adhesives are minded on the outside surface of the substrate with a coefficient of thermal expansion large in order to solve the above-mentioned technical problem, as a result of this invention person's inquiring among the substrate which pinches a liquid crystal layer, and an opposite substrate. After sticking the monotonous member which has a different predetermined coefficient of thermal expansion from the coefficient of thermal expansion of this substrate and heating beyond predetermined temperature, by returning to ordinary temperature It found out that the cel thickness of a liquid crystal cell could be equalized by it incurvating a header, a substrate, and an opposite substrate in the same configuration that this substrate and this monotonous member can be incurvated in a predetermined configuration.
[0027] The curve approach of the substrate which this invention person found out is explained.
[0028] if it returns to ordinary temperature after sticking the monotonous member which has a different predetermined coefficient of thermal expansion from the coefficient of thermal expansion of this substrate through adhesives on the outside surface of a substrate with a large coefficient of thermal expansion and heating beyond predetermined temperature -- the one where the one among this substrate and this monotonous member where a coefficient of thermal expansion is larger is smaller -- a temperature up -- large -- expanding -- a temperature fall -- ** -- it contracts greatly.
[0029] Therefore, when the coefficient of thermal expansion of a monotonous member is smaller than the coefficient of thermal expansion of a substrate, a substrate and a monotonous member curve so that a monotonous member side may become a convex. On the other hand, when the coefficient of thermal expansion of a monotonous member is larger than the coefficient of thermal expansion of a substrate, a substrate and a monotonous member curve so that a substrate side may become a convex.
[0030] Thus, since a substrate can be beforehand incurvated in the configuration as a small substrate where another [which curves in the formation process of a sealant by controlling the difference of the coefficient of thermal expansion of a substrate and a monotonous member] coefficient of thermal expansion is the same, the cel thickness of a liquid crystal cell can be equalized.
[0031] Namely, the means which this invention provided in order to solve the above-mentioned technical problem In the manufacture approach of the liquid crystal equipment which consists of an ingredient with which two substrates which were stuck at the predetermined spacing through the sealant in the periphery section, which pinch a liquid crystal layer, and which counter differ After sticking the monotonous member which has a different predetermined coefficient of thermal expansion from this substrate through adhesives on the outside surface of the substrate with a large coefficient of thermal expansion between said two substrates which counter and heating beyond predetermined temperature, by returning to ordinary temperature After incurvating this

substrate and this monotonous member in a predetermined configuration, it is characterized by sticking this substrate and said another substrate through said sealant.
[0032] According to this means, the manufacture approach of the liquid crystal equipment which can equalize spacing (cel thickness of a liquid crystal cell) with another [which curves in the formation process of a sealant] substrate can be offered by incurvating beforehand the substrate with a large coefficient of thermal expansion between two substrates which pinch a liquid crystal layer and which counter in a predetermined configuration.
[0033] Moreover, it sets to the liquid crystal equipment which consists of an ingredient with which two substrates which were stuck at the predetermined spacing through the sealant by this means in the periphery section, which pinch a liquid crystal layer, and which counter differ. Adhesives are minded on the outside surface of the substrate with a large coefficient of thermal expansion between said two substrates which counter. The monotonous member which has a different predetermined coefficient of thermal expansion from this substrate is stuck, and the liquid crystal equipment which is characterized by this substrate, this monotonous member, and said another substrate curving in a predetermined configuration and which was excellent in display quality can be offered.
[0034] Moreover, the electronic equipment which was excellent in display quality can be offered by having this liquid crystal equipment.
[0035] In the above means, when said monotonous member is what has a coefficient of thermal expansion smaller than the coefficient of thermal expansion of said substrate, it is characterized by incurvating said substrate and said monotonous member so that this monotonous member side may become a convex. When said monotonous member is what has a larger coefficient of thermal expansion than the coefficient of thermal expansion of said substrate, it is characterized by incurvating said substrate and said monotonous member so that this substrate side may become a convex.
[0036] It is desirable for the difference of the coefficient of thermal expansion of said substrate and said monotonous member to be equal to the difference of the coefficient of thermal expansion of another [said] substrate and said substrate in the case of which. Said substrate which stuck said monotonous member can be incurvated in the same configuration as another substrate by making the difference of the coefficient of thermal expansion of said substrate and said monotonous member equal to the difference of the coefficient of thermal expansion of another [said] substrate and said substrate.
[0037] Moreover, as for said adhesives, it is desirable to consist of the same ingredient as said sealant. Said substrate which stuck said monotonous member can be incurvated in the same configuration as another substrate by using said adhesives as the same ingredient as said sealant, and hardening these adhesives on the conditions which harden this sealant.
[0038]
[Embodiment of the Invention] Next, the operation gestalt concerning this invention is explained to a detail.
[0039] 1st operation gestalt drawing 1 (a) Process drawing showing the manufacture approach of the reflective mold liquid crystal display 10 using the MOSFET (METARUOKISAIDOSHIRIKON field emission transistor) component 20 as a switching element of the 1st operation gestalt concerning this invention is shown in - (e), and this manufacture approach is explained to it. Drawing 1 (a) - (e) shows the outline sectional view.
[0040] In this operation gestalt, the substrate (bottom substrate) 11 which pinches the liquid crystal layer 13, and a different substrate as opposite substrates (top substrate) 12 are used, and the direction of the coefficient of thermal expansion of the opposite substrate 12 is smaller than the coefficient of thermal expansion of a substrate 11. For example, the substrate which consists of single crystal silicon and glass, respectively is used as a substrate 11 and an opposite substrate 12. Moreover, in the formation process of the sealant 14 which sticks a substrate 11 and the opposite substrate 12, the opposite substrate 12 shall curve so that an internal-surface side (liquid crystal layer 13 side) may become a convex.
[0041] As shown in drawing 1 (a), on the internal surface (illustration top front face) of a substrate 11, the MOSFET component 20 for driving the pixel electrode (reflector) 15 which consists of aluminum which reflects light, and each pixel electrode 15 etc. is formed, and the orientation film 18 is formed on the pixel electrode 15 and the MOSFET component 20.
[0042] The top view which expanded the situation when seeing the substrate 11 before forming the orientation film 18 in drawing 2 from a top is shown. Drawing 1 R> 1 (a) is a sectional view shown along with the A-A' line of drawing 2 .
[0043] As shown in drawing 2 , on the substrate 11, the scanning line 22 and the data line 16 are arranged in the

shape of a matrix, each pixel is arranged according to the intersection of the scanning line 22 and the data line 16, and the MOSFET component 20 for driving the pixel electrode 15 and each pixel electrode 15 to each pixel is formed. About detailed explanation of the MOSFET component 20, it mentions later.

[0044] Next, as shown in drawing 1 (b), monotonous member 11A which has a predetermined coefficient of thermal expansion which is different in a substrate 11 is stuck through thermosetting adhesive or photoresist adhesives on the outside surface (illustration bottom front face) of a substrate 11. At this time, monotonous member 11A is selected so that the coefficient of thermal expansion of monotonous member 11A may become smaller than the coefficient of thermal expansion of a substrate 11. Moreover, it is desirable to set up so that the difference of the coefficient of thermal expansion of the opposite substrate 12 and a substrate 11 and the difference of the coefficient of thermal expansion of a substrate 11 and monotonous member 11A may become equal. Monotonous member 11A may consist of same ingredients as the opposite substrate 12.

[0045] When the adhesives which stuck a substrate 11 and monotonous member 11A are thermosetting adhesive, adhesives are hardened by heating at about 100-160 degrees C. Moreover, when the used adhesives are photoresist adhesives, adhesives are hardened by irradiating ultraviolet rays etc. An ultraviolet ray lamp is used for hardening of photoresist adhesives, and a temperature up is carried out to about 80 degrees C by generation of heat of an ultraviolet ray lamp. Moreover, when which adhesives are used, after hardening reaction termination lowers temperature to ordinary temperature.

[0046] When the used adhesives are any of thermosetting adhesive and photoresist adhesives, a substrate 11 and monotonous member 11A are heated by the temperature of about 100-160 degrees C or about 80 degrees C. this time -- monotonous member 11A with a substrate 11 and the substrate 11 with a large coefficient of thermal expansion among opposite substrate 11A small [a coefficient of thermal expansion] -- a temperature up -- large -- expanding -- a temperature fall -- ** -- it contracts greatly.

[0047] Consequently, as shown in drawing 1 (c), a substrate 11 and monotonous member 11A curve so that the monotonous member 11A side may become a convex.

[0048] Next, as shown in drawing 1 (d), the common electrode 17 and the orientation film 19 stick the opposite substrate 12 by which sequential formation was carried out, and a substrate 11 at the predetermined spacing through sealant 14A which is not hardened [which consists of thermosetting adhesive or photoresist adhesives] on an internal surface.

[0049] Next, as shown in drawing 1 (e), sealant 14A is hardened and a sealant 14 is formed. When sealant 14A is thermosetting adhesive, adhesives are hardened by heating at about 100-160 degrees C. Moreover, when sealant 14A is photoresist adhesives, adhesives are hardened by irradiating ultraviolet rays etc. An ultraviolet ray lamp is used for hardening of photoresist adhesives, and a temperature up is carried out to about 80 degrees C by generation of heat of an ultraviolet ray lamp. Moreover, when which adhesives are used, after hardening reaction termination lowers temperature to ordinary temperature.

[0050] When the adhesives used as sealant 14A are any of thermosetting adhesive and photoresist adhesives, a substrate 11 and monotonous member 11A are heated by the temperature of 100-160 degrees C or about 80 degrees C. At this time, since the coefficient of thermal expansion of the opposite substrate 12 is smaller than the coefficient of thermal expansion of a substrate 11, thermal expansion of the small opposite substrate 12 is carried out more greatly than a substrate 11. However, since the periphery section of the opposite substrate 12 is being fixed by sealant 14A or 14, the opposite substrate 12 curves so that an internal-surface side may become a convex.

[0051] Finally, the liquid crystal layer 13 is enclosed between a substrate 11 and the opposite substrate 12, and by illustration, although omitted, a phase contrast plate and a polarizing plate are installed in the outside of monotonous member 11A and the opposite substrate 12, and a liquid crystal display 10 is manufactured.

[0052] Here, the detail of the MOSFET (METARUOKISAIDOSHIRIKON field emission transistor) component 20 is explained.

[0053] In order to show the detail of the MOSFET component 20 in drawing 3 , the sectional view shown along with the B-B' line of drawing 2 is shown.

[0054] The well field 21 is formed on a substrate 11, and the field oxide 23 for isolation is formed on the well field 21. Opening is formed in field oxide 23, gate oxide 24 is formed in the center of the inside of this opening, gate electrode 22a and the scanning line 22 are formed in gate oxide 24 front face, and the 1st interlayer insulation film 25 is formed on it. A contact hole 26 is formed in source field 42a, thereby, opening of the 1st interlayer insulation film 25 is carried out, the data line 16 is formed here, and connection with source field 42a

is achieved. Moreover, after the data line 16 is formed, the 2nd interlayer insulation film 27 is formed further. A contact hole 28 is formed in drain field 42b, thereby, the 1st interlayer insulation film 25 and the 2nd interlayer insulation film 27 carry out opening, the pixel electrode 15 is formed here, and connection with drain field 42b is achieved. Moreover, between the 1st interlayer insulation film 25 and the 2nd interlayer insulation film 27, the conductive layer 29 for capacity are recording is formed.

[0055] In this operation gestalt, although the liquid crystal display with the coefficient of thermal expansion of the opposite substrate 12 smaller than the coefficient of thermal expansion of a substrate 11 among a substrate 11 and the opposite substrate 12 was explained This invention is not limited to this and its ** with the coefficient of thermal expansion of a substrate 11 smaller than the coefficient of thermal expansion of the opposite substrate 12 is also good. In that case What is necessary is to stick monotonous member 11A which has a coefficient of thermal expansion smaller than the coefficient of thermal expansion of the opposite substrate 12 on the outside surface of the opposite substrate 12, and just to curve so that the monotonous member 11A side may become a convex about the opposite substrate 12 and monotonous member 11A.

[0056] According to this operation gestalt, a substrate 11 can be curved in a predetermined configuration by sticking monotonous member 11A which has the predetermined coefficient of thermal expansion from which a coefficient of thermal expansion differs on the outside surface of a substrate 11, carrying out a temperature up beyond predetermined temperature, and returning to ordinary temperature.

[0057] In this operation gestalt, it is desirable to set up so that the difference of the coefficient of thermal expansion of the opposite substrate 12 and a substrate 11 and the difference of the coefficient of thermal expansion of a substrate 11 and monotonous member 11A may become equal. Moreover, it is desirable to use the adhesives same as adhesives which stick a substrate 11 and monotonous member 11A as sealant 14A.

[0058] A substrate 11 and the opposite substrate 12 can be incurvated in the same configuration by setting up so that the difference of the coefficient of thermal expansion of the opposite substrate 12 and a substrate 11 and the difference of the coefficient of thermal expansion of a substrate 11 and monotonous member 11A may become equal, and hardening adhesives under the same conditions using the adhesives same as adhesives which stick a substrate 11 and monotonous member 11A as sealant 14A.

[0059] Thus, according to this operation gestalt, since it can curve in the same configuration as the opposite substrate 12 which curves a substrate 11 in the formation process of a sealant 14, the cel thickness of a liquid crystal cell is equalized and the manufacture approach of a liquid crystal display and liquid crystal display which were excellent in display quality can be offered.

[0060] Moreover, in this operation gestalt, although the reflective mold liquid crystal display was explained, this invention is not limited to a reflective mold and can apply a transparency mold, a reflective transflective type, etc. to any liquid crystal equipments. In addition, this operation gestalt is effective in especially the liquid crystal display for projection mold liquid crystal displays that cannot arrange a spacer.

[0061] Process drawing showing the manufacture approach of the reflective mold liquid crystal display 30 using an MOSFET component as a switching element of the 2nd operation gestalt concerning this invention is shown in 2nd operation gestalt drawing 4 , and the manufacture approach is explained to it. In drawing 4 , the same reference mark is given to the same component as a liquid crystal display 10.

[0062] In this operation gestalt, the substrate (bottom substrate) 31 which pinches the liquid crystal layer 13, and a different substrate as opposite substrates (top substrate) 32 are used, the direction of the coefficient of thermal expansion of the opposite substrate 32 becomes smaller than the coefficient of thermal expansion of a substrate 31, and it is small. For example, the substrate which consists of single crystal silicon and glass, respectively is used as a substrate 31 and an opposite substrate 32. Moreover, in the formation process of the sealant 14 which sticks a substrate 31 and the opposite substrate 32, the opposite substrate 32 shall curve so that an outside-surface side may become a convex.

[0063] As shown in drawing 4 (a), on the internal surface (illustration top front face) of a substrate 31, the MOSFET component 20 for driving the pixel electrode (reflector) 15 which consists of aluminum which reflects light like the 1st operation gestalt, and each pixel electrode 15 etc. is formed.

[0064] Since the detailed structure of the top view which expanded the situation when seeing the substrate 31 before forming the orientation film 18 from a top, and the MOSFET component 20 is the same as that of what was shown by drawing 2 and drawing 3 , explanation is omitted.

[0065] Next, as shown in drawing 4 (b), monotonous member 31A which has a predetermined coefficient of thermal expansion which is different in a substrate 31 is stuck through thermosetting adhesive or photoresist

adhesives on the outside surface (illustration bottom front face) of a substrate 31. At this time, monotonous member 31A is selected so that the coefficient of thermal expansion of monotonous member 31A may become larger than the coefficient of thermal expansion of a substrate 31. Moreover, it is desirable to set up so that the difference of the coefficient of thermal expansion of the opposite substrate 32 and a substrate 31 and the difference of the coefficient of thermal expansion of a substrate 31 and monotonous member 31A may become equal.

[0066] When the adhesives which stuck a substrate 31 and monotonous member 31A are thermosetting adhesive, adhesives are hardened by heating at about 100-160 degrees C. Moreover, when the used adhesives are photoresist adhesives, adhesives are hardened by irradiating ultraviolet rays etc. An ultraviolet ray lamp is used for hardening of photoresist adhesives, and a temperature up is carried out to about 80 degrees C by generation of heat of an ultraviolet ray lamp. Moreover, when which adhesives are used, after hardening reaction termination lowers temperature to ordinary temperature.

[0067] When the used adhesives are any of thermosetting adhesive and photoresist adhesives, a substrate 31 and monotonous member 31A are heated by the temperature of about 100-160 degrees C or about 80 degrees C. this time -- monotonous member 31A with a large coefficient of thermal expansion among a substrate 31 and monotonous member 31A -- the substrate 31 with a small coefficient of thermal expansion -- a temperature up -- large -- expanding -- a temperature fall -- ** -- it contracts greatly.

[0068] Consequently, as shown in drawing 4 (c), a substrate 31 and monotonous member 31A curve so that a substrate 31 side may become a convex.

[0069] Next, as shown in drawing 4 (d), the common electrode 17 and the orientation film 19 stick the opposite substrate 32 by which sequential formation was carried out, and a substrate 31 at the predetermined spacing through sealant 14A which is not hardened [which consists of thermosetting adhesive or photoresist adhesives] on an internal surface.

[0070] Next, as shown in drawing 4 (e), sealant 14A is hardened and a sealant 14 is formed. When sealant 14A is thermosetting adhesive, adhesives are hardened by heating at about 100-160 degrees C. Moreover, when sealant 14A is photoresist adhesives, adhesives are hardened by irradiating ultraviolet rays etc. An ultraviolet ray lamp is used for hardening of photoresist adhesives, and a temperature up is carried out to about 80 degrees C by generation of heat of an ultraviolet ray lamp. Moreover, when which adhesives are used, after hardening reaction termination lowers temperature to ordinary temperature.

[0071] When the adhesives used as sealant 14A are any of thermosetting adhesive and photoresist adhesives, a substrate 31 and monotonous member 31A are heated by the temperature of about 100-160 degrees C or about 80 degrees C. At this time, since the coefficient of thermal expansion of the opposite substrate 32 is smaller than the coefficient of thermal expansion of a substrate 31, thermal expansion of the substrate 31 is carried out more greatly than the opposite substrate 32. However, since the periphery section of the opposite substrate 32 is being fixed by sealant 14A or 14, the opposite substrate 32 curves so that an outside-surface side may become a convex.

[0072] Finally, the liquid crystal layer 13 is enclosed between a substrate 31 and the opposite substrate 32, and by illustration, although omitted, a phase contrast plate and a polarizing plate are installed in the outside of monotonous member 31A and the opposite substrate 32, and a liquid crystal display 30 is manufactured.

[0073] In this operation gestalt, although the liquid crystal display with the coefficient of thermal expansion of the opposite substrate 32 smaller than the coefficient of thermal expansion of a substrate 31 among a substrate 31 and the opposite substrate 32 was explained This invention may not be limited to this and its coefficient of thermal expansion of the opposite substrate 32 may be larger than the coefficient of thermal expansion of a substrate 31. In that case What is necessary is to stick monotonous member 31A which has a larger coefficient of thermal expansion than the coefficient of thermal expansion of the opposite substrate 32 on the outside surface of the opposite substrate 32, and just to curve so that the opposite substrate 32 side may become a convex about the opposite substrate 32 and monotonous member 31A.

[0074] According to this operation gestalt, a substrate 31 can be curved in a predetermined configuration by sticking monotonous member 31A which has the predetermined coefficient of thermal expansion from which a coefficient of thermal expansion differs on the outside surface of a substrate 31, carrying out a temperature up beyond predetermined temperature, and returning to ordinary temperature.

[0075] In this operation gestalt, it is desirable to set up so that the difference of the coefficient of thermal expansion of the opposite substrate 32 and a substrate 31 and the difference of the coefficient of thermal

expansion of a substrate 31 and monotonous member 31A may become equal. Moreover, it is desirable to use the adhesives same as adhesives which stick a substrate 31 and monotonous member 31A as sealant 14A.
[0076] A substrate 31 and the opposite substrate 32 can be incurvated in the same configuration by setting up so that the difference of the coefficient of thermal expansion of the opposite substrate 32 and a substrate 31 and the difference of the coefficient of thermal expansion of a substrate 31 and monotonous member 31A may become equal, and hardening adhesives under the same conditions using the adhesives same as adhesives which stick a substrate 31 and monotonous member 31A as sealant 14A.
[0077] Thus, according to this operation gestalt, since it can curve in the same configuration as the opposite substrate 32 which curves a substrate 31 in the formation process of a sealant 14, the cel thickness of a liquid crystal cell is equalized and the manufacture approach of a liquid crystal display and liquid crystal display which were excellent in display quality can be offered.
[0078] Moreover, in this operation gestalt, although the reflective mold liquid crystal display was explained, this invention is not limited to a reflective mold and can apply a transparency mold, a reflective transflective type, etc. to any liquid crystal equipments. This operation gestalt is effective in both the liquid crystal display for a projection mold display which cannot arrange a spacer, and the liquid crystal display for direct viewing type liquid crystal displays which arranges a spacer.
[0079] In addition, in the 1st and 2nd operation gestalt, although only the liquid crystal display using an MOSFET component was explained This invention is not what is limited to this. For example, simple matrix type liquid crystal equipment, The liquid crystal equipment using 2 terminal mold component represented by the MIM (Metal-Insulator-Metal) component, It is applicable also to the liquid crystal equipment using 3 terminal mold component represented by the TFT (Thin-Film Transistor) component, and if it is liquid crystal equipment which consists of an ingredient with which two substrates which pinch a liquid crystal layer, and which counter differ, it is applicable to any liquid crystal equipments.
[0080] Next, the example of electronic equipment equipped with the liquid crystal display 10 of the aforementioned 1st and 2nd operation gestalt or either of 30 is explained.
[0081] Drawing 5 (a) is the perspective view having shown an example of a cellular phone. In drawing 5 (a), 40 shows the body of a cellular phone and 41 shows the liquid crystal display section equipped with the aforementioned liquid crystal display 10 or either of 30.
[0082] Drawing 5 (b) is the perspective view having shown an example of pocket mold information processors, such as a word processor and a personal computer. In drawing 5 (b), the liquid crystal display section which 50 equipped with the information processor and 51 equipped with the input sections, such as a keyboard, the liquid crystal display 10 of the above [53 / an information processing body and 52], or either of 30 is shown.
[0083] Drawing 5 (c) is the perspective view having shown an example of wrist watch mold electronic equipment. In drawing 5 (c), 60 shows the body of a clock and 61 shows the liquid crystal display section equipped with the aforementioned liquid crystal display 10 or either of 30.
[0084] Drawing 6 is the outline block diagram showing the important section of the projector (projection mold liquid crystal display) which used the aforementioned liquid crystal display 10 or either of 30 as light modulation equipment.
[0085] This projector S polarization flux of light by which outgoing radiation was carried out from the light source section 71 arranged in accordance with the system optical axis L, the integrator lens 72, the polarization lighting system 70 by which an outline configuration is carried out from the polarization sensing element 73, and the polarization lighting system 70 according to S polarization flux of light reflector 81 The inside of the light reflected from S polarization reflector 81 of a polarization beam splitter 80 and a polarization beam splitter 80 to reflect, High-reflective-liquid-crystal light modulation equipment 85B which modulates the dichroic mirror 82 which separates the component of blue glow (B), and the separated blue glow (B), High-reflective-liquid-crystal light modulation equipment 85R which modulates the dichroic mirror 83 which is made to reflect the component of red light (R) among the flux of lights after blue glow was separated, and is separated, and the separated red light (R), High-reflective-liquid-crystal light modulation equipment 85G which modulate the remaining green light (G) which penetrates a dichroic mirror 83, The light modulated with three high-reflective-liquid-crystal light modulation equipments 85R, 85G, and 85B is compounded by dichroic mirrors 82 and 83 and the polarization beam splitter 80, and it consists of incident light study systems 90 which consist of a projector lens which projects this synthetic light on a screen 91. The aforementioned liquid crystal display 10 or either of 30 is used for the three above-mentioned high-reflective-liquid-crystal light modulation equipments

85R, 85G, and 85B, respectively.
[0086] Drawing 5 (a) Since each electronic equipment shown in - (c) and drawing 6 is equipped with the aforementioned liquid crystal display 10 or either of 30, it becomes what was excellent in display quality.
[0087]
[Effect of the Invention] [as explained above, when it consists of ingredients with which two substrates which pinch a liquid crystal layer, and which counter differ according to this invention] By sticking the monotonous member which has the predetermined coefficient of thermal expansion in which a coefficient of thermal expansion differs from this substrate, carrying out a temperature up beyond predetermined temperature, and returning at ordinary temperature on the outside surface of the substrate with a large coefficient of thermal expansion between two substrates Since this substrate can be incurvated in a predetermined configuration, this substrate can be made into the same configuration as another [which curves in the formation process of a sealant] substrate. The cel thickness of a liquid crystal cell is equalized and the manufacture approach of a liquid crystal display and liquid crystal display which were excellent in display quality can be offered.
[0088] Moreover, the electronic equipment which was excellent in display quality can be offered by having this liquid crystal display.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] This invention relates to electronic equipment equipped with the liquid crystal equipment manufactured by the manufacture approach of the liquid crystal equipment which consists of an ingredient with which two substrates which are applied to the manufacture approach, liquid crystal equipment, and electronic equipment of liquid crystal equipment, especially pinch a liquid crystal layer, and which counter differ, and this manufacture approach, and this liquid crystal equipment.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] As a liquid crystal display, the direct viewing type liquid crystal display carried in a cellular phone, a pocket mold information processor, etc. and projection mold liquid crystal displays, such as a projector, are known.
[0003] The outline sectional view of the common liquid crystal display 100 used for a direct viewing type liquid crystal display is shown in drawing 7 , and the structure of this liquid crystal display is explained to it.
[0004] As shown in drawing 7 , a substrate (bottom substrate) 101 and the opposite substrate (top substrate) 102 are stuck at intervals of predetermined through a sealant 104 in each periphery section, and the liquid crystal layer 103 is enclosed between the substrate 101 and the opposite substrate 102. On the inside of a substrate 101 and the opposite substrate 102, transparent electrodes 105 and 106 are formed by the predetermined pattern, respectively, and the orientation film 107 and 108 is formed on a transparent electrode 105 and 106.
[0005] Although a phase contrast plate and a polarizing plate are installed in the outside of a substrate 101 and the opposite substrate 102, it is omitting in illustration.
[0006] In the liquid crystal display 100, in order to keep constant spacing (cel thickness of a liquid crystal cell) of a substrate 101 and the opposite substrate 102, many spherical spacers 109 which consist of a silicon dioxide, polystyrene, etc. are arranged between the substrate 101 and the opposite substrate 102.
[0007] Next, the outline sectional view of the common liquid crystal display 200 used for a projection mold liquid crystal display is shown in drawing 8 , and the structure of this liquid crystal display is explained to it. In drawing 8 , the same reference number is given to the same component as a liquid crystal display 100, and explanation is omitted.
[0008] In a liquid crystal display 200, since a spacer is also expanded and displayed when the spacer has been arranged between a substrate 101 and the opposite substrate 102 in order to display by carrying out expansion projection of the liquid crystal panel, optical leakage arises into the part and there is a problem of reducing display quality. Therefore, in a liquid crystal display 200, as shown in drawing 8 , a spacer cannot be arranged between a substrate 101 and the opposite substrate 102.

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EFFECT OF THE INVENTION

[Effect of the Invention] [as explained above, when it consists of ingredients with which two substrates which pinch a liquid crystal layer, and which counter differ according to this invention] By sticking the monotonous member which has the predetermined coefficient of thermal expansion in which a coefficient of thermal expansion differs from this substrate, carrying out a temperature up beyond predetermined temperature, and returning at ordinary temperature on the outside surface of the substrate with a large coefficient of thermal expansion between two substrates Since this substrate can be incurvated in a predetermined configuration, this substrate can be made into the same configuration as another [which curves in the formation process of a sealant] substrate. The cel thickness of a liquid crystal cell is equalized and the manufacture approach of a liquid crystal display and liquid crystal display which were excellent in display quality can be offered.
[0088] Moreover, the electronic equipment which was excellent in display quality can be offered by having this liquid crystal display.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In a common liquid crystal display as shown with the above-mentioned liquid crystal display 100,200, although the same substrate is usually used as a substrate 101 and an opposite substrate 102, a different substrate may be used.
[0010] The reflective mold liquid crystal display 300 with which a different substrate is used as a substrate 101 and an opposite substrate 102 and which is used for a projection mold display as an example at drawing 9 is shown, and the structure of this liquid crystal display is explained. In drawing 9 , the same reference number is given to the same component as a liquid crystal display 200, and explanation is omitted.
[0011] On the substrate 101, many reflectors 305 which consist of aluminum which reflects light are formed in the shape of a matrix, and the switching element for driving each reflector 305 is prepared. The orientation film 107 is formed on the reflector 305 and the switching element.
[0012] In this liquid crystal display 300, the light which carried out incidence into the liquid crystal panel from the outside of the opposite substrate 102 passes the liquid crystal layer 103, it is reflected on reflector 305 front face, and it passes the opposite substrate 102, and is emitted to the exterior of a liquid crystal panel.
[0013] In this liquid crystal display 300, when a substrate 101 consists of single crystal ingredients, such as single crystal silicon, and the switching element is formed on this single crystal substrate, the reflector 305 formed on a substrate 101 can be switched to a high speed rather than the time of consisting of a switching element formed on amorphous materials, such as glass.
[0014] Since the light reflected with the reflector 305 passes the opposite substrate 102 on the other hand, it is emitted to the exterior of a liquid crystal display 300 and a display is performed, it is needed that the opposite substrate 102 is transparent. Therefore, opaque single crystal silicon etc. cannot be used as an opposite substrate 102.
[0015] Therefore, since the substrate which consists of single crystal ingredients, such as single crystal silicon, as a substrate 101 is used and the substrate which consists of transparent materials, such as glass, as an opposite substrate 102 is used when forming a transistor on the case where the high-speed response of the reflective mold liquid crystal display 300 is carried out, or a substrate 101, the substrate which consists of a different ingredient as a substrate 101 and an opposite substrate 102 is used.
[0016] In the liquid crystal display 300 with which a different substrate is used as a substrate 101 and an opposite substrate 102, in the production process of a liquid crystal display 300, in case a sealant 104 is formed, it has the trouble of producing cel thickness nonuniformity between a substrate 101 and the opposite substrate 102.
[0017] A sealant 104 applies thermosetting adhesive or photoresist adhesives between the periphery sections of a substrate 101 and the opposite substrate 102, and is formed by hardening adhesives. In the case of thermosetting adhesive, hardening of adhesives is performed by usually heating at about 100-160 degrees C, and, in the case of photoresist adhesives, is performed by irradiating ultraviolet rays etc. In the case of photoresist adhesives, heating is not performed, but it is generation of heat from that of an ultraviolet ray lamp, and a temperature up is carried out to about 80 degrees C.
[0018] Therefore, as a sealant 104, when using any of thermosetting adhesive and photoresist adhesives, a liquid crystal cell is heated by about 100-160 degrees C or about 80 degrees C.
[0019] Since a different substrate as a substrate 101 and an opposite substrate 102 is used in that case, the coefficients of thermal expansion of a substrate 101 and the opposite substrate 102 differ, and a substrate with a large coefficient of thermal expansion expands greatly with a temperature rise as compared with a substrate with a small coefficient of thermal expansion. Furthermore, since the periphery section of a substrate is being

fixed by the sealant 104, a curve arises in the substrate which expanded.
[0020] For example, when single crystal silicon and the opposite substrate 102 consist [a substrate 101] of glass, it curves so that the internal-surface side of the opposite substrate 102 may become a convex, or since the coefficient of thermal expansion is larger than glass, as the direction of single crystal silicon shows the opposite substrate 102 to drawing 10 (a), as shown in drawing 10 R> 0 (b), it curves so that the outside-surface side of the opposite substrate 102 may become a convex. When the opposite substrate 102 is level, the gap from from is the most remarkable also in curve [which / of the opposite substrate 102 shown in drawing 10 (a) and (b)] in the center section of the opposite substrate 102. For example, as for gap g in the center section of the opposite substrate 102, the thickness of 0.6x10 to 3 m and the opposite substrate 102 is about 1x10-6m, when the thickness of a substrate 101 is 0.7x10 to 3 m. Therefore, there is a trouble that distribution of an about [1x10-6m] arises also in the thickness (cel thickness of a liquid crystal cell) of the liquid crystal layer 103 pinched by a substrate 101 and the opposite substrate 102. Since the cel thickness of a liquid crystal cell is about 3-6x10-6m, this gap is large.
[0021] If the above problem is a liquid crystal display which consists of a substrate with which a substrate 101 differs from the opposite substrate 102 instead of the problem restricted to the reflective mold liquid crystal display 300 for a projection mold display, it is a problem produced in any liquid crystal displays.
[0022] In the common liquid crystal display 100 for direct viewing type liquid crystal displays which arranges a spacer 109, although the curve of the opposite substrate 102 shown by drawing 10 (a) can be prevented, even if it arranges a spacer 109, the curve of the opposite substrate 102 shown by drawing 10 (b) cannot be prevented.
[0023] Moreover, neither of the curves of the opposite substrates 102 shown by drawing 10 (a) and drawing 10 (b) can be prevented, but a problem is remarkable in the common liquid crystal display 200 (300 is included) for projection mold liquid crystal displays which does not arrange a spacer.
[0024] Here, a problem in case distribution arises is explained to the cel thickness of a liquid crystal cell. If distribution arises in the cel thickness of a liquid crystal cell, it is known in the liquid crystal display that the display engine performance will get worse. Especially in the liquid crystal display in STN (Super Twisted Nematic) mode, it is known that the permeability of light will change with change of deltan-d value (however, deltan the rate of a birefringence of liquid crystal and d cel thickness), and since distribution will occur in light transmittance, i.e., brightness, if distribution of the deltan-d value change d, i.e., cel thickness, is large, contrast falls. Although losing peculiar yellow and blue coloring with a phase contrast plate, and compensating black and white in STN mode will be performed if distribution of the deltan-d value change d, i.e., cel thickness, is large, at this time, an optical property will get worse and an irregular color will arise in a display. Moreover, if the cel thickness d has distribution, the steepness of liquid crystal will get worse and contrast will fall. Thus, since contrast gets worse and an irregular color occurs in a display when distribution arises in the cel thickness d, there is a problem that display quality deteriorates.
[0025] Then, this invention solves the above-mentioned trouble and it aims at offering the manufacture approach of the liquid crystal display which enables equalization of the cel thickness of a liquid crystal cell in the manufacture approach of the liquid crystal display which consists of an ingredient with which the substrate which pinches a liquid crystal layer differs from an opposite substrate. Moreover, it aims at offering the electronic equipment which was excellent in display quality by having this liquid crystal display further for the purpose of offering the liquid crystal display which was excellent in display quality by this manufacture approach.

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MEANS

[Means for Solving the Problem] Adhesives are minded on the outside surface of the substrate with a coefficient of thermal expansion large in order to solve the above-mentioned technical problem, as a result of this invention person's inquiring among the substrate which pinches a liquid crystal layer, and an opposite substrate. After sticking the monotonous member which has a different predetermined coefficient of thermal expansion from the coefficient of thermal expansion of this substrate and heating beyond predetermined temperature, by returning to ordinary temperature It found out that the cel thickness of a liquid crystal cell could be equalized by it incurvating a header, a substrate, and an opposite substrate in the same configuration that this substrate and this monotonous member can be incurvated in a predetermined configuration.
[0027] The curve approach of the substrate which this invention person found out is explained.
[0028] if it returns to ordinary temperature after sticking the monotonous member which has a different predetermined coefficient of thermal expansion from the coefficient of thermal expansion of this substrate through adhesives on the outside surface of a substrate with a large coefficient of thermal expansion and heating beyond predetermined temperature -- the one where the one among this substrate and this monotonous member where a coefficient of thermal expansion is larger is smaller -- a temperature up -- large -- expanding -- a temperature fall -- ** -- it contracts greatly.
[0029] Therefore, when the coefficient of thermal expansion of a monotonous member is smaller than the coefficient of thermal expansion of a substrate, a substrate and a monotonous member curve so that a monotonous member side may become a convex. On the other hand, when the coefficient of thermal expansion of a monotonous member is larger than the coefficient of thermal expansion of a substrate, a substrate and a monotonous member curve so that a substrate side may become a convex.
[0030] Thus, since a substrate can be beforehand incurvated in the configuration as a small substrate where another [which curves in the formation process of a sealant by controlling the difference of the coefficient of thermal expansion of a substrate and a monotonous member] coefficient of thermal expansion is the same, the cel thickness of a liquid crystal cell can be equalized.
[0031] Namely, the means which this invention provided in order to solve the above-mentioned technical problem In the manufacture approach of the liquid crystal equipment which consists of an ingredient with which two substrates which were stuck at the predetermined spacing through the sealant in the periphery section, which pinch a liquid crystal layer, and which counter differ After sticking the monotonous member which has a different predetermined coefficient of thermal expansion from this substrate through adhesives on the outside surface of the substrate with a large coefficient of thermal expansion between said two substrates which counter and heating beyond predetermined temperature, by returning to ordinary temperature After incurvating this substrate and this monotonous member in a predetermined configuration, it is characterized by sticking this substrate and said another substrate through said sealant.
[0032] According to this means, the manufacture approach of the liquid crystal equipment which can equalize spacing (cel thickness of a liquid crystal cell) with another [which curves in the formation process of a sealant] substrate can be offered by incurvating beforehand the substrate with a large coefficient of thermal expansion between two substrates which pinch a liquid crystal layer and which counter in a predetermined configuration.
[0033] Moreover, it sets to the liquid crystal equipment which consists of an ingredient with which two substrates which were stuck at the predetermined spacing through the sealant by this means in the periphery section, which pinch a liquid crystal layer, and which counter differ. Adhesives are minded on the outside surface of the substrate with a large coefficient of thermal expansion between said two substrates which counter. The monotonous member which has a different predetermined coefficient of thermal expansion from

this substrate is stuck, and the liquid crystal equipment which is characterized by this substrate, this monotonous member, and said another substrate curving in a predetermined configuration and which was excellent in display quality can be offered.
[0034] Moreover, the electronic equipment which was excellent in display quality can be offered by having this liquid crystal equipment.
[0035] In the above means, when said monotonous member is what has a coefficient of thermal expansion smaller than the coefficient of thermal expansion of said substrate, it is characterized by incurvating said substrate and said monotonous member so that this monotonous member side may become a convex. When said monotonous member is what has a larger coefficient of thermal expansion than the coefficient of thermal expansion of said substrate, it is characterized by incurvating said substrate and said monotonous member so that this substrate side may become a convex.
[0036] It is desirable for the difference of the coefficient of thermal expansion of said substrate and said monotonous member to be equal to the difference of the coefficient of thermal expansion of another [said] substrate and said substrate in the case of which. Said substrate which stuck said monotonous member can be incurvated in the same configuration as another substrate by making the difference of the coefficient of thermal expansion of said substrate and said monotonous member equal to the difference of the coefficient of thermal expansion of another [said] substrate and said substrate.
[0037] Moreover, as for said adhesives, it is desirable to consist of the same ingredient as said sealant. Said substrate which stuck said monotonous member can be incurvated in the same configuration as another substrate by using said adhesives as the same ingredient as said sealant, and hardening these adhesives on the conditions which harden this sealant.
[0038]
[Embodiment of the Invention] Next, the operation gestalt concerning this invention is explained to a detail.
[0039] 1st operation gestalt drawing 1 (a) Process drawing showing the manufacture approach of the reflective mold liquid crystal display 10 using the MOSFET (METARUOKISAIDOSHIRIKON field emission transistor) component 20 as a switching element of the 1st operation gestalt concerning this invention is shown in - (e), and this manufacture approach is explained to it. Drawing 1 (a) - (e) shows the outline sectional view.
[0040] In this operation gestalt, the substrate (bottom substrate) 11 which pinches the liquid crystal layer 13, and a different substrate as opposite substrates (top substrate) 12 are used, and the direction of the coefficient of thermal expansion of the opposite substrate 12 is smaller than the coefficient of thermal expansion of a substrate 11. For example, the substrate which consists of single crystal silicon and glass, respectively is used as a substrate 11 and an opposite substrate 12. Moreover, in the formation process of the sealant 14 which sticks a substrate 11 and the opposite substrate 12, the opposite substrate 12 shall curve so that an internal-surface side (liquid crystal layer 13 side) may become a convex.
[0041] As shown in drawing 1 (a), on the internal surface (illustration top front face) of a substrate 11, the MOSFET component 20 for driving the pixel electrode (reflector) 15 which consists of aluminum which reflects light, and each pixel electrode 15 etc. is formed, and the orientation film 18 is formed on the pixel electrode 15 and the MOSFET component 20.
[0042] The top view which expanded the situation when seeing the substrate 11 before forming the orientation film 18 in drawing 2 from a top is shown. Drawing 1 R> 1 (a) is a sectional view shown along with the A-A' line of drawing 2 .
[0043] As shown in drawing 2 , on the substrate 11, the scanning line 22 and the data line 16 are arranged in the shape of a matrix, each pixel is arranged according to the intersection of the scanning line 22 and the data line 16, and the MOSFET component 20 for driving the pixel electrode 15 and each pixel electrode 15 to each pixel is formed. About detailed explanation of the MOSFET component 20, it mentions later.
[0044] Next, as shown in drawing 1 (b), monotonous member 11A which has a predetermined coefficient of thermal expansion which is different in a substrate 11 is stuck through thermosetting adhesive or photoresist adhesives on the outside surface (illustration bottom front face) of a substrate 11. At this time, monotonous member 11A is selected so that the coefficient of thermal expansion of monotonous member 11A may become smaller than the coefficient of thermal expansion of a substrate 11. Moreover, it is desirable to set up so that the difference of the coefficient of thermal expansion of the opposite substrate 12 and a substrate 11 and the difference of the coefficient of thermal expansion of a substrate 11 and monotonous member 11A may become equal. Monotonous member 11A may consist of same ingredients as the opposite substrate 12.

[0045] When the adhesives which stuck a substrate 11 and monotonous member 11A are thermosetting adhesive, adhesives are hardened by heating at about 100-160 degrees C. Moreover, when the used adhesives are photoresist adhesives, adhesives are hardened by irradiating ultraviolet rays etc. An ultraviolet ray lamp is used for hardening of photoresist adhesives, and a temperature up is carried out to about 80 degrees C by generation of heat of an ultraviolet ray lamp. Moreover, when which adhesives are used, after hardening reaction termination lowers temperature to ordinary temperature.
[0046] When the used adhesives are any of thermosetting adhesive and photoresist adhesives, a substrate 11 and monotonous member 11A are heated by the temperature of about 100-160 degrees C or about 80 degrees C. this time -- monotonous member 11A with a substrate 11 and the substrate 11 with a large coefficient of thermal expansion among opposite substrate 11A small [a coefficient of thermal expansion] -- a temperature up -- large -- expanding -- a temperature fall -- ** -- it contracts greatly.
[0047] Consequently, as shown in drawing 1 (c), a substrate 11 and monotonous member 11A curve so that the monotonous member 11A side may become a convex.
[0048] Next, as shown in drawing 1 (d), the common electrode 17 and the orientation film 19 stick the opposite substrate 12 by which sequential formation was carried out, and a substrate 11 at the predetermined spacing through sealant 14A which is not hardened [which consists of thermosetting adhesive or photoresist adhesives] on an internal surface.
[0049] Next, as shown in drawing 1 (e), sealant 14A is hardened and a sealant 14 is formed. When sealant 14A is thermosetting adhesive, adhesives are hardened by heating at about 100-160 degrees C. Moreover, when sealant 14A is photoresist adhesives, adhesives are hardened by irradiating ultraviolet rays etc. An ultraviolet ray lamp is used for hardening of photoresist adhesives, and a temperature up is carried out to about 80 degrees C by generation of heat of an ultraviolet ray lamp. Moreover, when which adhesives are used, after hardening reaction termination lowers temperature to ordinary temperature.
[0050] When the adhesives used as sealant 14A are any of thermosetting adhesive and photoresist adhesives, a substrate 11 and monotonous member 11A are heated by the temperature of 100-160 degrees C or about 80 degrees C. At this time, since the coefficient of thermal expansion of the opposite substrate 12 is smaller than the coefficient of thermal expansion of a substrate 11, thermal expansion of the small opposite substrate 12 is carried out more greatly than a substrate 11. However, since the periphery section of the opposite substrate 12 is being fixed by sealant 14A or 14, the opposite substrate 12 curves so that an internal-surface side may become a convex.
[0051] Finally, the liquid crystal layer 13 is enclosed between a substrate 11 and the opposite substrate 12, and by illustration, although omitted, a phase contrast plate and a polarizing plate are installed in the outside of monotonous member 11A and the opposite substrate 12, and a liquid crystal display 10 is manufactured.
[0052] Here, the detail of the MOSFET (METARUOKISAIDOSHIRIKON field emission transistor) component 20 is explained.
[0053] In order to show the detail of the MOSFET component 20 in drawing 3 , the sectional view shown along with the B-B' line of drawing 2 is shown.
[0054] The well field 21 is formed on a substrate 11, and the field oxide 23 for isolation is formed on the well field 21. Opening is formed in field oxide 23, gate oxide 24 is formed in the center of the inside of this opening, gate electrode 22a and the scanning line 22 are formed in gate oxide 24 front face, and the 1st interlayer insulation film 25 is formed on it. A contact hole 26 is formed in source field 42a, thereby, opening of the 1st interlayer insulation film 25 is carried out, the data line 16 is formed here, and connection with source field 42a is achieved. Moreover, after the data line 16 is formed, the 2nd interlayer insulation film 27 is formed further. A contact hole 28 is formed in drain field 42b, thereby, the 1st interlayer insulation film 25 and the 2nd interlayer insulation film 27 carry out opening, the pixel electrode 15 is formed here, and connection with drain field 42b is achieved. Moreover, between the 1st interlayer insulation film 25 and the 2nd interlayer insulation film 27, the conductive layer 29 for capacity are recording is formed.
[0055] In this operation gestalt, although the liquid crystal display with the coefficient of thermal expansion of the opposite substrate 12 smaller than the coefficient of thermal expansion of a substrate 11 among a substrate 11 and the opposite substrate 12 was explained This invention is not limited to this and its ** with the coefficient of thermal expansion of a substrate 11 smaller than the coefficient of thermal expansion of the opposite substrate 12 is also good. In that case What is necessary is to stick monotonous member 11A which has a coefficient of thermal expansion smaller than the coefficient of thermal expansion of the opposite

substrate 12 on the outside surface of the opposite substrate 12, and just to curve so that the monotonous member 11A side may become a convex about the opposite substrate 12 and monotonous member 11A.
[0056] According to this operation gestalt, a substrate 11 can be curved in a predetermined configuration by sticking monotonous member 11A which has the predetermined coefficient of thermal expansion from which a coefficient of thermal expansion differs on the outside surface of a substrate 11, carrying out a temperature up beyond predetermined temperature, and returning to ordinary temperature.
[0057] In this operation gestalt, it is desirable to set up so that the difference of the coefficient of thermal expansion of the opposite substrate 12 and a substrate 11 and the difference of the coefficient of thermal expansion of a substrate 11 and monotonous member 11A may become equal. Moreover, it is desirable to use the adhesives same as adhesives which stick a substrate 11 and monotonous member 11A as sealant 14A.
[0058] A substrate 11 and the opposite substrate 12 can be incurvated in the same configuration by setting up so that the difference of the coefficient of thermal expansion of the opposite substrate 12 and a substrate 11 and the difference of the coefficient of thermal expansion of a substrate 11 and monotonous member 11A may become equal, and hardening adhesives under the same conditions using the adhesives same as adhesives which stick a substrate 11 and monotonous member 11A as sealant 14A.
[0059] Thus, according to this operation gestalt, since it can curve in the same configuration as the opposite substrate 12 which curves a substrate 11 in the formation process of a sealant 14, the cel thickness of a liquid crystal cell is equalized and the manufacture approach of a liquid crystal display and liquid crystal display which were excellent in display quality can be offered.
[0060] Moreover, in this operation gestalt, although the reflective mold liquid crystal display was explained, this invention is not limited to a reflective mold and can apply a transparency mold, a reflective transflective type, etc. to any liquid crystal equipments. In addition, this operation gestalt is effective in especially the liquid crystal display for projection mold liquid crystal displays that cannot arrange a spacer.
[0061] Process drawing showing the manufacture approach of the reflective mold liquid crystal display 30 using an MOSFET component as a switching element of the 2nd operation gestalt concerning this invention is shown in 2nd operation gestalt drawing 4 , and the manufacture approach is explained to it. In drawing 4 , the same reference mark is given to the same component as a liquid crystal display 10.
[0062] In this operation gestalt, the substrate (bottom substrate) 31 which pinches the liquid crystal layer 13, and a different substrate as opposite substrates (top substrate) 32 are used, the direction of the coefficient of thermal expansion of the opposite substrate 32 becomes smaller than the coefficient of thermal expansion of a substrate 31, and it is small. For example, the substrate which consists of single crystal silicon and glass, respectively is used as a substrate 31 and an opposite substrate 32. Moreover, in the formation process of the sealant 14 which sticks a substrate 31 and the opposite substrate 32, the opposite substrate 32 shall curve so that an outside-surface side may become a convex.
[0063] As shown in drawing 4 (a), on the internal surface (illustration top front face) of a substrate 31, the MOSFET component 20 for driving the pixel electrode (reflector) 15 which consists of aluminum which reflects light like the 1st operation gestalt, and each pixel electrode 15 etc. is formed.
[0064] Since the detailed structure of the top view which expanded the situation when seeing the substrate 31 before forming the orientation film 18 from a top, and the MOSFET component 20 is the same as that of what was shown by drawing 2 and drawing 3 , explanation is omitted.
[0065] Next, as shown in drawing 4 (b), monotonous member 31A which has a predetermined coefficient of thermal expansion which is different in a substrate 31 is stuck through thermosetting adhesive or photoresist adhesives on the outside surface (illustration bottom front face) of a substrate 31. At this time, monotonous member 31A is selected so that the coefficient of thermal expansion of monotonous member 31A may become larger than the coefficient of thermal expansion of a substrate 31. Moreover, it is desirable to set up so that the difference of the coefficient of thermal expansion of the opposite substrate 32 and a substrate 31 and the difference of the coefficient of thermal expansion of a substrate 31 and monotonous member 31A may become equal.
[0066] When the adhesives which stuck a substrate 31 and monotonous member 31A are thermosetting adhesive, adhesives are hardened by heating at about 100-160 degrees C. Moreover, when the used adhesives are photoresist adhesives, adhesives are hardened by irradiating ultraviolet rays etc. An ultraviolet ray lamp is used for hardening of photoresist adhesives, and a temperature up is carried out to about 80 degrees C by generation of heat of an ultraviolet ray lamp. Moreover, when which adhesives are used, after hardening

reaction termination lowers temperature to ordinary temperature.
[0067] When the used adhesives are any of thermosetting adhesive and photoresist adhesives, a substrate 31 and monotonous member 31A are heated by the temperature of about 100-160 degrees C or about 80 degrees C. this time -- monotonous member 31A with a large coefficient of thermal expansion among a substrate 31 and monotonous member 31A -- the substrate 31 with a small coefficient of thermal expansion -- a temperature up -- large -- expanding -- a temperature fall -- ** -- it contracts greatly.
[0068] Consequently, as shown in drawing 4 (c), a substrate 31 and monotonous member 31A curve so that a substrate 31 side may become a convex.
[0069] Next, as shown in drawing 4 (d), the common electrode 17 and the orientation film 19 stick the opposite substrate 32 by which sequential formation was carried out, and a substrate 31 at the predetermined spacing through sealant 14A which is not hardened [which consists of thermosetting adhesive or photoresist adhesives] on an internal surface.
[0070] Next, as shown in drawing 4 (e), sealant 14A is hardened and a sealant 14 is formed. When sealant 14A is thermosetting adhesive, adhesives are hardened by heating at about 100-160 degrees C. Moreover, when sealant 14A is photoresist adhesives, adhesives are hardened by irradiating ultraviolet rays etc. An ultraviolet ray lamp is used for hardening of photoresist adhesives, and a temperature up is carried out to about 80 degrees C by generation of heat of an ultraviolet ray lamp. Moreover, when which adhesives are used, after hardening reaction termination lowers temperature to ordinary temperature.
[0071] When the adhesives used as sealant 14A are any of thermosetting adhesive and photoresist adhesives, a substrate 31 and monotonous member 31A are heated by the temperature of about 100-160 degrees C or about 80 degrees C. At this time, since the coefficient of thermal expansion of the opposite substrate 32 is smaller than the coefficient of thermal expansion of a substrate 31, thermal expansion of the substrate 31 is carried out more greatly than the opposite substrate 32. However, since the periphery section of the opposite substrate 32 is being fixed by sealant 14A or 14, the opposite substrate 32 curves so that an outside-surface side may become a convex.
[0072] Finally, the liquid crystal layer 13 is enclosed between a substrate 31 and the opposite substrate 32, and by illustration, although omitted, a phase contrast plate and a polarizing plate are installed in the outside of monotonous member 31A and the opposite substrate 32, and a liquid crystal display 30 is manufactured.
[0073] In this operation gestalt, although the liquid crystal display with the coefficient of thermal expansion of the opposite substrate 32 smaller than the coefficient of thermal expansion of a substrate 31 among a substrate 31 and the opposite substrate 32 was explained This invention may not be limited to this and its coefficient of thermal expansion of the opposite substrate 32 may be larger than the coefficient of thermal expansion of a substrate 31. In that case What is necessary is to stick monotonous member 31A which has a larger coefficient of thermal expansion than the coefficient of thermal expansion of the opposite substrate 32 on the outside surface of the opposite substrate 32, and just to curve so that the opposite substrate 32 side may become a convex about the opposite substrate 32 and monotonous member 31A.
[0074] According to this operation gestalt, a substrate 31 can be curved in a predetermined configuration by sticking monotonous member 31A which has the predetermined coefficient of thermal expansion from which a coefficient of thermal expansion differs on the outside surface of a substrate 31, carrying out a temperature up beyond predetermined temperature, and returning to ordinary temperature.
[0075] In this operation gestalt, it is desirable to set up so that the difference of the coefficient of thermal expansion of the opposite substrate 32 and a substrate 31 and the difference of the coefficient of thermal expansion of a substrate 31 and monotonous member 31A may become equal. Moreover, it is desirable to use the adhesives same as adhesives which stick a substrate 31 and monotonous member 31A as sealant 14A.
[0076] A substrate 31 and the opposite substrate 32 can be incurvated in the same configuration by setting up so that the difference of the coefficient of thermal expansion of the opposite substrate 32 and a substrate 31 and the difference of the coefficient of thermal expansion of a substrate 31 and monotonous member 31A may become equal, and hardening adhesives under the same conditions using the adhesives same as adhesives which stick a substrate 31 and monotonous member 31A as sealant 14A.
[0077] Thus, according to this operation gestalt, since it can curve in the same configuration as the opposite substrate 32 which curves a substrate 31 in the formation process of a sealant 14, the cel thickness of a liquid crystal cell is equalized and the manufacture approach of a liquid crystal display and liquid crystal display which were excellent in display quality can be offered.

[0078] Moreover, in this operation gestalt, although the reflective mold liquid crystal display was explained, this invention is not limited to a reflective mold and can apply a transparency mold, a reflective transflective type, etc. to any liquid crystal equipments. This operation gestalt is effective in both the liquid crystal display for a projection mold display which cannot arrange a spacer, and the liquid crystal display for direct viewing type liquid crystal displays which arranges a spacer.
[0079] In addition, in the 1st and 2nd operation gestalt, although only the liquid crystal display using an MOSFET component was explained This invention is not what is limited to this. For example, simple matrix type liquid crystal equipment, The liquid crystal equipment using 2 terminal mold component represented by the MIM (Metal-Insulator-Metal) component, It is applicable also to the liquid crystal equipment using 3 terminal mold component represented by the TFT (Thin-Film Transistor) component, and if it is liquid crystal equipment which consists of an ingredient with which two substrates which pinch a liquid crystal layer, and which counter differ, it is applicable to any liquid crystal equipments.
[0080] Next, the example of electronic equipment equipped with the liquid crystal display 10 of the aforementioned 1st and 2nd operation gestalt or either of 30 is explained.
[0081] Drawing 5 (a) is the perspective view having shown an example of a cellular phone. In drawing 5 (a), 40 shows the body of a cellular phone and 41 shows the liquid crystal display section equipped with the aforementioned liquid crystal display 10 or either of 30.
[0082] Drawing 5 (b) is the perspective view having shown an example of pocket mold information processors, such as a word processor and a personal computer. In drawing 5 (b), the liquid crystal display section which 50 equipped with the information processor and 51 equipped with the input sections, such as a keyboard, the liquid crystal display 10 of the above [53 / an information processing body and 52], or either of 30 is shown.
[0083] Drawing 5 (c) is the perspective view having shown an example of wrist watch mold electronic equipment. In drawing 5 (c), 60 shows the body of a clock and 61 shows the liquid crystal display section equipped with the aforementioned liquid crystal display 10 or either of 30.
[0084] Drawing 6 is the outline block diagram showing the important section of the projector (projection mold liquid crystal display) which used the aforementioned liquid crystal display 10 or either of 30 as light modulation equipment.
[0085] This projector S polarization flux of light by which outgoing radiation was carried out from the light source section 71 arranged in accordance with the system optical axis L, the integrator lens 72, the polarization lighting system 70 by which an outline configuration is carried out from the polarization sensing element 73, and the polarization lighting system 70 according to S polarization flux of light reflector 81 The inside of the light reflected from S polarization reflector 81 of a polarization beam splitter 80 and a polarization beam splitter 80 to reflect, High-reflective-liquid-crystal light modulation equipment 85B which modulates the dichroic mirror 82 which separates the component of blue glow (B), and the separated blue glow (B), High-reflective-liquid-crystal light modulation equipment 85R which modulates the dichroic mirror 83 which is made to reflect the component of red light (R) among the flux of lights after blue glow was separated, and is separated, and the separated red light (R), High-reflective-liquid-crystal light modulation equipment 85G which modulate the remaining green light (G) which penetrates a dichroic mirror 83, The light modulated with three high-reflective-liquid-crystal light modulation equipments 85R, 85G, and 85B is compounded by dichroic mirrors 82 and 83 and the polarization beam splitter 80, and it consists of incident light study systems 90 which consist of a projector lens which projects this synthetic light on a screen 91. The aforementioned liquid crystal display 10 or either of 30 is used for the three above-mentioned high-reflective-liquid-crystal light modulation equipments 85R, 85G, and 85B, respectively.
[0086] Drawing 5 (a) Since each electronic equipment shown in - (c) and drawing 6 is equipped with the aforementioned liquid crystal display 10 or either of 30, it becomes what was excellent in display quality.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing 1 (a) - (e) is process drawing showing the manufacture approach of the reflective mold liquid crystal display of the 1st operation gestalt concerning this invention.
[Drawing 2] Drawing 2 is the top view expanding and showing the reflective mold liquid crystal display of the 1st operation gestalt concerning this invention.
[Drawing 3] Drawing 3 is the sectional view showing the structure of the TFT component in the reflective mold liquid crystal display of the 1st operation gestalt concerning this invention.
[Drawing 4] Drawing 4 (a) - (e) is process drawing showing the manufacture approach of the reflective mold liquid crystal display of the 2nd operation gestalt concerning this invention.
[Drawing 5] Drawing showing an example of the cellular phone equipped with the liquid crystal display with which drawing 5 (a) was manufactured according to the above-mentioned operation gestalt, drawing showing an example of the pocket mold information processor equipped with the liquid crystal display with which drawing 5 (b) was manufactured according to the above-mentioned operation gestalt, and drawing 5 (c) are drawings showing an example of wrist watch mold electronic equipment equipped with the liquid crystal display manufactured according to the above-mentioned operation gestalt.
[Drawing 6] Drawing 6 is the outline block diagram showing the important section of a projector using the liquid crystal display manufactured according to the above-mentioned operation gestalt as light modulation equipment.
[Drawing 7] Drawing 7 is the outline sectional view showing the structure of the common liquid crystal display for direct viewing type liquid crystal displays.
[Drawing 8] Drawing 8 is the outline sectional view showing the structure of the common liquid crystal display for projection mold liquid crystal displays.
[Drawing 9] Drawing 9 is the outline sectional view showing the structure of the reflective mold liquid crystal display for projection mold liquid crystal displays.
[Drawing 10] Drawing 10 (a) and (b) are drawings explaining the problem of a curve of the substrate in the reflective mold liquid crystal display for projection mold liquid crystal displays.
[Description of Notations]
10 30 Liquid crystal display
11 31 Substrate
11A, 31A Monotonous member
12 32 Opposite substrate
13 Liquid Crystal Layer
14 Sealant
14A A non-hardened sealant
15 Pixel Electrode (Reflector)
16 Data Line
17 Common Electrode
18 19 Orientation film
20 MOSFET Component
22 Scanning Line

[Translation done.]

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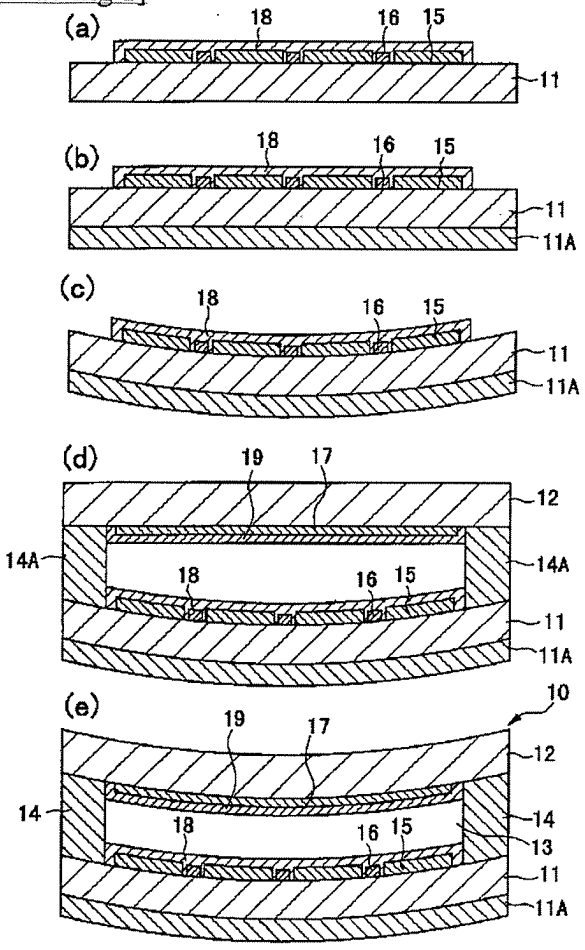
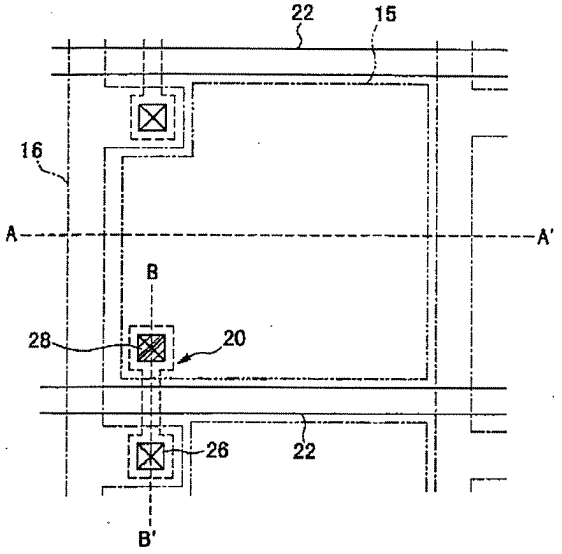
DRAWINGS

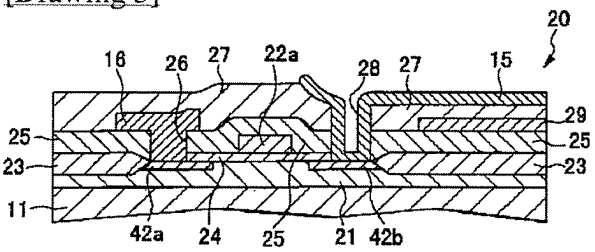
[Drawing 1]



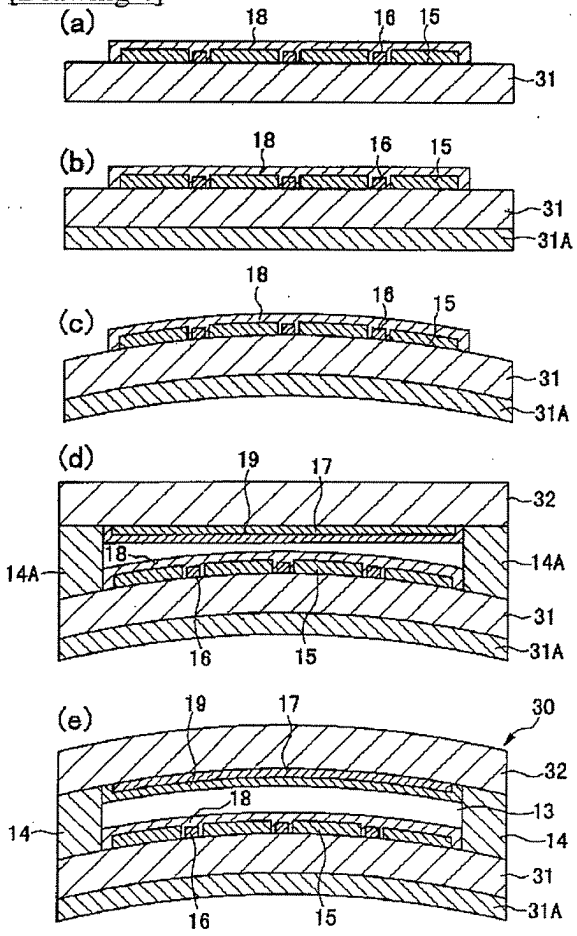
[Drawing 2]



[Drawing 3]

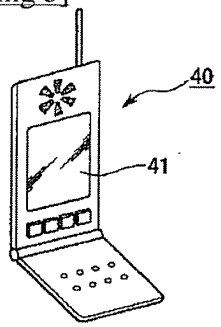


[Drawing 4]

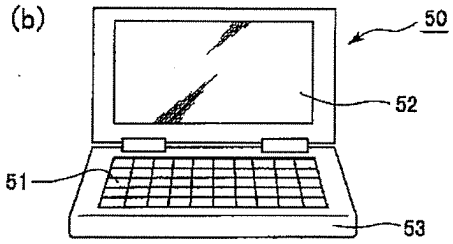


[Drawing 5]

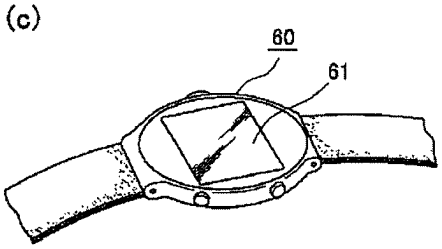
(a)



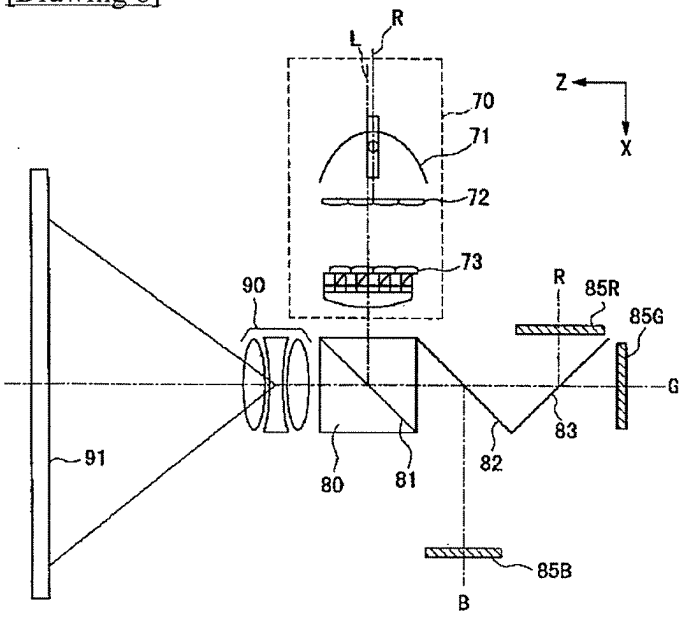
(b)



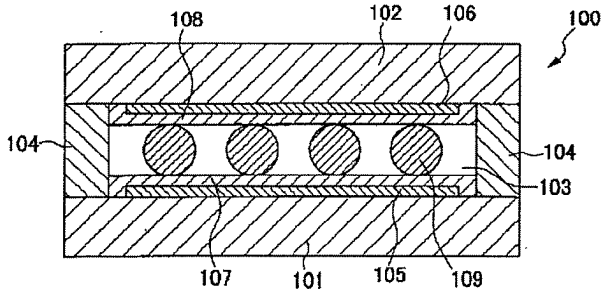
(c)



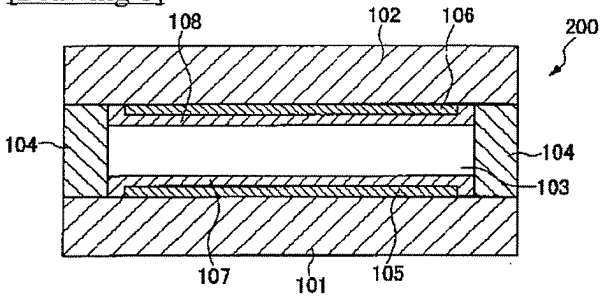
[Drawing 6]



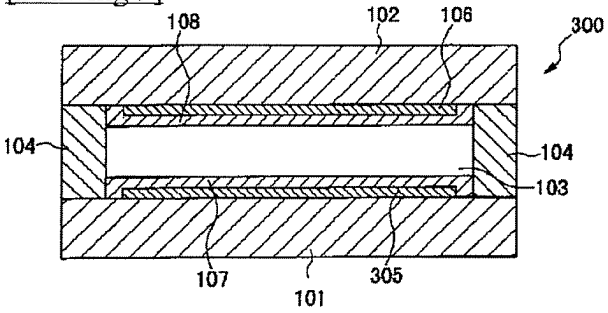
[Drawing 7]



[Drawing 8]

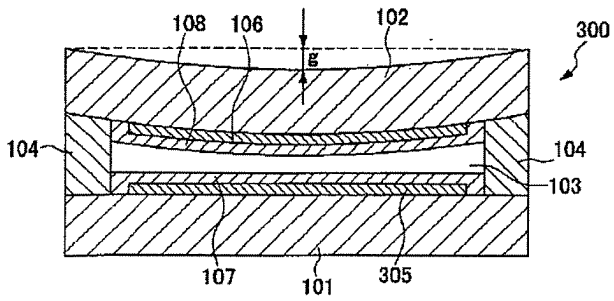


[Drawing 9]

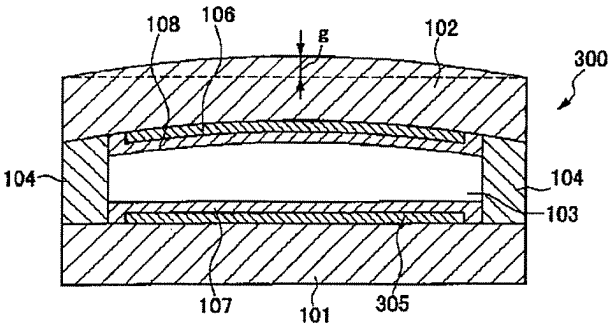


[Drawing 10]

(a)



(b)



[Translation done.]